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SWAMP-PASTURES OF THE LOWER WAIKATO BASIN.

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IN winter, low-lying lands alongside the Waikato River are flooded with water, and show little or no promise of the surprising change to luxuriant pasture which comes with the summer and the fall in the waters of the Waikato. For six months these areas lie covered in water many feet deep in places, to be succeeded as the floods recede by swards of grass of extremely high production and palatable to stock—some of them very palatable. The change is all the more remarkable in that at present only very small areas, comparative to the large size of the flooded swamps of the Lower Waikato, show this unusual transition. Most of the area in the summer grows a profusion of useless rushes.

Truly the grass family is a remarkable one. It provides species capable of living in a great variety of conditions. Representatives can be seen growing on the seashore in sea mud, in dry soils, in high altitudes, and there are also species suited to swamp completely covered with water for half the year. Little attention has been paid so far to the use which can be made of land flooded with water for long periods. Such land is usually considered useless, and endeavours are made to drain it so that it will grow the grasses which thrive only in comparatively dry soils. Grass species which will grow without necessitating drainage—grasses forming carpets of green, fit to fatten cattle, produce butterfat, graze pigs and lambs—are not very well known, and their use has not been considered much.

A natural home for these grasses can be seen in the lower reaches of the Waikato River.

The Waikato rises in the volcanic plateau of the North Island, and its waters carry in suspension or roll along the river-bed great quantities of pumice sand. In the middle part of its course the river is mature and the bed is deep, and flooding does not occur.

At Taupiri, however, the river enters hilly country throughout which it pursues its course to the sea. Here and there throughout this hilly country the narrow valley widens out to form flood-plains on which the river deposits its burden of spoil from the central volcanic plateau. The river deposits most of this pumice material near its banks and so raises their level. Many of the numerous tributaries

which here join the river have not been able to fill their valleys as quickly as the dams across their outlets have been raised, and numbers of lakes and swamps have been formed. The principal lakes on the east side are Karaka (138 acres), Waikare (8,461 acres), Ohinewai (51 acres), Kimihia (672 acres), Hokanoa (170 acres), and, on the western side, Whangape (2,914 acres), Rotongaro (1,107 acres), and Wahi (1,242 acres). These, though they differ in size, all have the following essential points in common: they are very shallow, their surfaces are but little above the normal river-bed, and their outlets are across wide swampy flats of the present flood-plain. Throughout the swamps wander streams from the hills to connect directly with the river and streams connecting lake with river.

Owing to the upbuilding of the Waikato River banks, some of the lakes that at one time discharged into the Waikato now overflow into other lakes or rivers, the water seeping across wide swamps. Thus Lake Ohinewai drains to Lake Waikare, and Lake Rotongaro into the stream from Lake Whangape. Some lakes, such as Lake Waikare, partly discharge directly into the Waikato and partly into Whangamarino Swamp, which is drained by two streams into the Waikato.

Long sprawling spurs of rolling dry country reach out into the flood-plain, from which also low rounded hills rise like islands. The topography of this basin has obviously been produced by the smothering of a mature valley-system with river alluvium.

Along lake edges and the banks of the tributaries and waters of the Waikato River where they run through the flood-plain, pasture-plants have established here and there from isolated plants to areas containing hundreds of acres of land. Most of the flood-plain, consisting of thousands of acres, is covered in rushes, and there are also large areas of New Zealand flax.

The different pasture-plants existing on the flood-plain occupy differing levels, from areas covered deeply in water in winter to almost dry land. Their presence and prevalence is dependent on three factors:—

(1) The period of time the area is covered in water in winter and the depth of water in summer:

(2) Competition with other swamp-plants:

(3) The stocking of the area.

It is difficult to decide whether the line dividing the presence and absence of a pasture-plant indicates the period it will undergo submersion or whether it is the line marking its toleration of other swamp-plants which thrive under wetter or drier conditions. Also, the stocking of the area and the reaction of the different grass species to the degree of stocking have a bearing on their prevalence.

On the dry land alongside the swamps, dry-land pasture-plants, such as brown-top, white clover, suckling clover, and sweet vernal, and paspalum, are common. On top-dressed areas rye-grass is common. In the gullies descending to the flood-plain paspalum and *Lotus major* and Yorkshire fog are prevalent. In those gullies in which the water remains in the summer and flows but slowly, being stagnant in

FIG. 1. PASTURE OF POA AQUATICA AT KOPUKU.
(Photograph taken on 8th March, 1935, after growth of eighteen days.)

FIG. 2. MEADOW OF PASPALUM DISTICHUM AT WHANGAMARINO.
Fat lambs and cattle graze this meadow. *P. distichum* is also growing in the water at the edge of the creek.
(Photograph taken on 8th March, 1935.)

appearance, rushes are common, and competing with them strongly often is found the native punic grass (*Isachne Australis*), a rather unpleasant-looking grass with rusty green foliage which, however, provides a fair amount of not unpalatable fodder for stock in the summer. In these gullies the water does not reach a high level for more than a few hours, and is seldom deeper than 3 ft. In the summer, being fed by springs, they seldom run dry. It is here, whether the drying-out occurs or not, that the native punic grass thrives. Where the gully slopes to the flood-plain the native punic grass ceases to exist, for it apparently cannot live where submersion is fairly deep or it cannot tolerate the competition of other plants in such conditions.

Paspalum dilatatum and Yorkshire fog cease abruptly at the commencement of the flood-plain proper, and do not even extend as far into it as the native punic grass. *Paspalum dilatatum* will stand flooding for but short intervals.

Agrostis stolonifera ventures to live a few yards farther out than *Paspalum dilatatum*, but its presence almost as abruptly ceases. It apparently will tolerate limited flooding and is a common and valuable, though low-producing, pasture-plant for such conditions. Stock are fond of it. It is commonly known as creeping-bent and possesses overground runners which root at the nodes. Its leaves and flowering-stem are typical of the *Agrostis* species. Of the clovers, two only exist in flooded waters—*Lotus major* and, peculiarly enough, white clover. These extend side by side a fair distance into the flood-plain—much farther than *Agrostis stolonifera*. Their prevalence and production under the conditions is very limited. They both probably owe their presence as the result of establishment of seed left by the receding flood. That their extent is limited to a certain distance from the shore is probably due to the smothering competition of deep-water swamp-grasses which increase in vigour farther from the shore.

Below the level at which *Paspalum dilatatum* thrives among the rushes is often found reed canary grass, *Phalaris arundiceae*, a tall, strong-growing grass which is capable of living in fairly wet conditions. Its presence, however, is generally limited to the growing of isolated clumps among the rushes where the cattle pick. Meadow-foxtail is another, not so strongly-growing grass, which provides fodder for stock under similar conditions to those under which *Phalaris arundiceae* lives.

Floating-foxtail (*Alopecurus geniculatus*) is capable of living in very wet conditions in places covered with water for months on end, but it thrives best on areas less completely submerged. It is not a vigorous grower, and its growth period appears limited to the early summer months.

All the pasture-plants which have been mentioned are not capable of great progress on the flood-plain even at the shallower edges. They exist in competition with rushes, and even when aided by the influence of stock they are unable to suppress rushes and other weeds.

But there are grasses for which the swamp forms so eminently suitable a habitat that all other growth is suppressed. These pasture-swards can be formed in much wetter conditions than where meadow-foxtail and its associates will live. Two of them do not assert themselves except in the deeper swamps, and many of these contain luxuriant

pastures free from useless plants, while the margins are mainly rushes with *Lotus major*, white clover, *Agrostis stolonifera*, and a few of the deeper swamp-grasses. These latter are not native grasses, and they have barely commenced an attack on the plants in their habitat in this region. Two species will live in swamps 2 ft. deep in summer with water which must be 6 ft. deep in winter. It is on land that dries out sufficiently in the summer to support stock that they are of economic value, and almost all of the flood-plain of the Lower Waikato Basin dries out sufficiently for this purpose. Growing as they do in the summer in a soil rich in food and moisture, their production is very great indeed. In winter, in one of the localities where they are established, a bare expanse of water is all there is to see—in the summer a

FIG. 3. PURE ASSOCIATION OF GLYCERIA FLUITANS, EXCEPT FOR TWO PLANTS OF WILLOW-WEED.

(Photograph taken on 2nd January, 1935.)

field of grass supporting numerous stock. These areas are of proved value for summer grazing of stock when the ordinary pastures are dried up.

These deep-water swamp-grasses form pure swards. They eliminate competition by their vigorous growth. At the present moment they are limited to the margins of streams and places near running water, but they gradually are extending their range. It is possible that finally they will provide large areas for grazing of stock. These grasses do not merely provide "pickings" for stock, but can make fields of pasture which compare very favourably with our dry-land pastures in their production, palatability, and their lack of weeds.

One of these grasses is *Poa aquatica*. It is the highest producer. It is like in appearance to maize, the seed-head resembling somewhat the male flower of the maize and standing as high. The stem is not

nearly as thick, however. The leaves are similar in appearance, but are much smaller, being yet very coarse compared with the common dry-land pasture-grasses. The foliage of the plant can be mistaken for raupo at a casual glance at a few yards' distance. The production of *Poa aquatica* is about 15 tons of green fodder per acre where it grows vigorously. It is capable of living in very deep water, and can be seen growing in places covered with several feet of water even in the driest of summers. But it grows best where the land is dry enough in the summer to support cattle. It also grows on dry land, but it prefers a position where water covers the ground throughout the winter. Frosts do not affect it to a large extent, and its climatic range is fairly great. That it is palatable can be seen from the way that stock graze fields of this grass to within a few inches of the ground. It has been considered not as palatable as the other swamp-grasses, but this may possibly be due to the fact that frequently the ground is too soft to support stock where it grows until midsummer, by which time it is coarse and has grown 7 ft. or 8 ft. in length. Even at this stage cattle eat it and keep in good condition on it. But its milking qualities are then not good. *Poa aquatica* sets seed freely, upon which it relies for reproduction. It appears, however, to be a perennial. It is capable, without the aid of stock, of suppressing vigorous rush-growth. With the advent of stocking it appears to be replaced by closer-growing swamp-grasses of spreading habit. The latter are seldom seen except in swamps where stock have ready access, whereas *Poa aquatica*, while prevalent in stocked areas, is more frequently observed making inroads against rushes and flax in unstocked areas.

Paspalum distichum or Mercer-grass is the most valuable of the swamp-grasses. It supplies by far most of the fodder for stock grazing in the swamps of the Lower Waikato Basin. It supplies fields of up to 100 acres consisting purely of this grass. It is essentially dependent on stock for its march of progress against the rushes of the swamp. This grass does not set seed freely, and spreads by over-ground runners which root at the nodes. There is no doubt about its palatability, as it is greedily eaten by stock, and it forms dense pleasing swards of dark green. It is at present confined to within about two miles of the margins of streams, from which it is possible that it will gradually spread over the large back-water swamps, some of which contain thousands of acres of useless land. It is at present making the greatest progress of any of the deep-water swamp-grasses, and, aided by stock, is gradually invading the rush-covered areas. Its production is probably higher than that of *Paspalum dilatatum* in its own habitat. When the flooded waters recede in the late spring, a bare expanse of oozing mud greets the eye. A little later here and there sickly green shoots of *Paspalum distichum* appear, and in a few weeks the ground is a solid sward of this grass, being fed usually by fattening cattle and dairy cows. This growth continues till the cold winter weather commences and the return of the water covers the area. Mercer-grass will live alongside *Poa aquatica* in the deeper waters, and its range in the other direction is apparently as good. It is difficult to distinguish it from *Paspalum vaginatum*, which lives in the driest of conditions and occurs as a vigorous weed on clay tennis-courts, and is frequently observed on roadsides.

Glyceria fluitans, or floating sweet grass, is also a sward-forming grass in areas covered more lightly with water in the winter than is

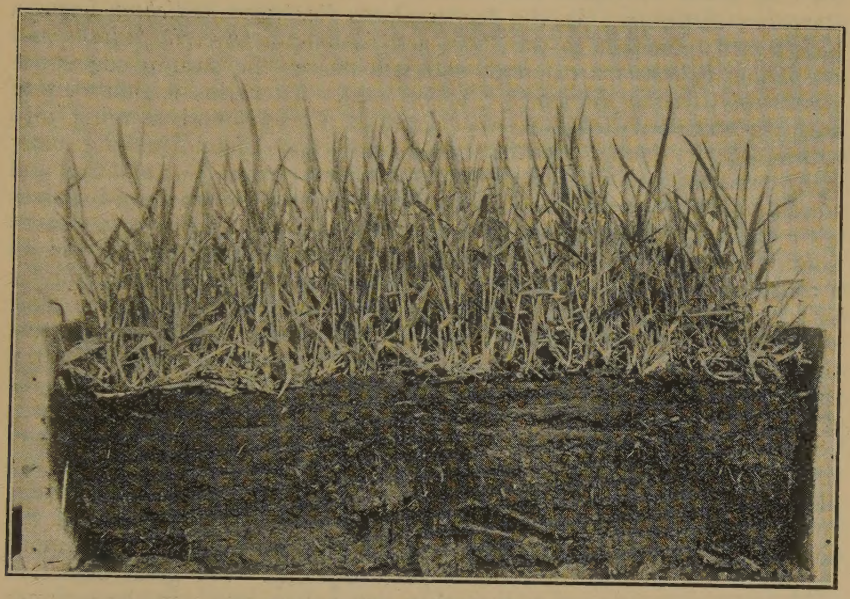

FIG. 4. PASPALUM DISTICHUM AT KOPUKU.
(Photograph taken on 18th February, 1935.)

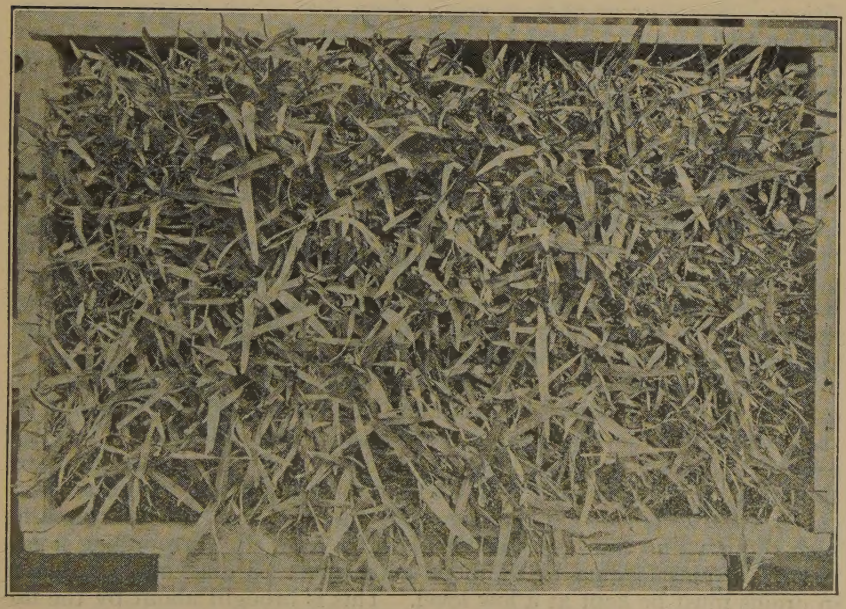

FIG. 5. CLOSER VIEW OF VEGETATION SHOWN IN FIG. 4.

the case where *Paspalum distichum* thrives. It is often associated with *Paspalum distichum*. In the deeper places *Paspalum distichum* forms a pure sward. Farther to the shore associations of *Glyceria fluitans* and *Paspalum distichum* are found, and still nearer the swamp edge pure swards of *Glyceria fluitans* are to be seen. After this a thin belt of creeping-bent and floating sweet grass is to be found merging into rushes and dry land. Floating sweet grass can be found making many acres productive alongside creeks. It differs from *Poa aquatica* and *Paspalum distichum* in that it is not dormant in the winter, and it lives with trailing stems moving with the flow of the water and its leaves floating canoe-like on top of the water. In the summer, when it throws a considerable amount of fodder, it sets seed, having a seed-head similar to rye-grass in appearance. In the winter stock will wade up to their bellies to pick mouthfuls of this palatable grass. However, relative to the summer production the winter production is not large. In the summer it appears as equally palatable as Mercer-grass. *Glyceria fluitans* is a common weed in drains.

The soils of the Lower Waikato swamps are for the great part formed by pumice silts deposited by the Waikato, but large areas are also composed of unconsolidated peat. The type of soil does not appear to affect greatly the grassing of these wet areas. The fertility of the soils of dry land depends largely on their capacity to give a continuous supply of moisture to the roots of pasture-plants. The great objection to drained peat swamps is that they dry out so much in the summer that pasture-plants will not grow. In an undrained state where the water-table is so high that they are always moist their suitability for the growth of many moisture-loving plants is quite satisfactory. Mercer-grass and creeping-bent thrive well on these soils in such conditions. Some areas of peat are so deep that when drained they are almost useless for pastoral purposes. There is no doubt that many acres of drained peat swamps would have been better utilized in a wet state by the colonization of them with moisture-loving grasses.

Of the alluvial areas, the alternative to non-expenditure of money on drainage and the establishment of summer producing swamp-grasses is the riddance effectively of the surplus water. If drainage is not completely successful so that rye-grass of high production can be established, the result will not be satisfactory. Half-drained land supports only rushes with a weak competition by grass and clover, and is of much poorer total potential production than land in its natural wet state. It has a virtue, however, which the undrained swamp does not possess, in that the area is able to carry stock every month in the year and not merely in the summer.

On the flooded areas of the Lower Waikato Basin sections of land can be freed of flooding by excluding the waters of the Waikato by stop-banks and the provision of flood-gates. But this does not go far enough. Having prevented the intrusion of water from the Waikato, the area will still remain too wet to grow rye-grass and vigorous white clover because of natural drainage into the area from the surrounding high country and the slow seepage of water from the surrounding flood-plain. Drains leading to the flood-gates must be dug, and the water in drains must be kept at a low level. This is brought about by the use of pumps which are driven cheaply by electrical power, and which raise the water from the drains and empty the water into the external flooded area over the flood-gate. By pumping the water in this manner in the wetter periods of the year it is possible to keep the water in the drains

at a very low level, while outside the flooded waters are above the level of the land. These pumps raise the water up a tube varying in diameter according to its working-capacity. The water is drawn up the tube by disk-like flanges working like a spiral, and the water issues over the stop-bank or through a flood-gate against the force of water outside.

The writer noticed these pumps first in 1929 on the Aka Aka Swamp, and at that time the only pump being operated was one patented by a local settler. The Aka Aka Swamp is situated in Franklin County near the mouth of the Waikato, and originally was one of the flood-plains used by the river. The area consists mainly of pumice silts with some areas of peat near the hills, which are derived from basic volcanic eruptions. This was stop-banked and huge canal-like drains led to flood-gates. These alone were not found effective enough by the settlers, and they commenced individually to block the outlets from farm drains to the main drains which run along the road frontages to their farms. The pumps, called Irwin's Swamp disk-pumps, and flood-gates were installed at the blocked junctions of the drains leading from the farms and the main canal-drains. These operated satisfactorily, and now numbers of farms on the Aka Aka area have the surplus winter water removed in this manner and farm drains are kept dry in winter, while outside the main drains are almost full of water. Electric-power lines run along the roads, and so connection with the power-supply is not expensive.

Pumps were used with tubes of 12 in., 15 in., and 18 in. diameters. An 18 in. pump required a 3 to 5 h.p. electric motor, a 15 in. pump a 3 h.p. motor, and the 12 in. pump a 1½ h.p. motor. The pumps were capable of a lift of 3 ft. 9 in. If a higher lift was required, two pumps could be used auxiliary to each other. The pumps were found capable of draining from 50 to 200 acres, the area drainable depending on the degree of wetness of the area and size of pump used. On one farm of 60 acres an 18 in. pump was found necessary for the wettest of seasons. A 12 in. pump had been installed and found to be unsatisfactory. On another of 140 acres a 15 in. pump dealt easily with the water. On the former farm power cost 3d. a unit and averaged £12 yearly, varying from £4 to £24 according to the winter rainfall. On the latter farm power cost 4d. a unit, and the average cost was £7.

The total costs in the above instances are set out below :—

60-acre Farm.	£	s.	d.
12 in. pump	10	0	0
Motor, wires, and one pole	14	0	0
Jarrah timbering for support of pump	5	0	0
Tin shed over motor and pump	10	0	0
Concrete work	3	0	0
Flood-gate	4	0	0
Total cost of materials and setting-in	£46	0	0

140-acre Farm.	£	s.	d.
15 in. pump	17	0	0
Motor	11	10	0
9 chains of poles and wire at £2 3s. per chain	19	7	0
Cement and sand	2	7	6
Total setting-in costs	£50	4	6

The pumps are capable of the following deliveries: 18 in. pump, 100,000 gallons per hour; 15 in. pump, 75,000 gallons; and 12 in. pump, 50,000 gallons. The pastures on the Aka Aka Swamp where well drained comprise good rye-grass, Yorkshire fog, paspalum, and white clover of high production. Where drainage is inefficient, rushes and catsear form a large proportion of the sward, and the production is low. It seems probable that the expulsion of water from the Aka Aka Swamp could have been brought about more economically and more efficiently by larger pumps operating at the entrance of the main canal-drains to the Waikato River.

Lately, attempts are being made by individuals to rid the water from small areas of the flood-plain in other parts of the Waikato Basin, using stop-banks, flood-gates, and pumps. On one area of 55 acres a pump capable of delivering 65,000 gallons per hour, costing £78 for pump and motor, has been used. This pump works automatically when the water rises to a certain level in the drain, and has removed in the season an equivalent of 45 in. of rainfall for £16, the cost of power being 1½d. per unit.

If the owner of a flooded swamp which dries out sufficiently in the summer to support stock wishes to make the area productive, he has two ways of doing so. He can adopt the well-tried method of drainage to dry the land so that it will support grasses suitable to dry conditions, or he can establish grasses suited to the land in its natural state. By effective drainage he will obtain production from the area the whole year round. Colonization with swamp-grasses will result in production only during the summer months. The establishment of rye-grass - white clover swards can be brought about only by much labour in the erection of stop-banks, digging of drains, preparation of a seed-bed, and expenditure in the purchase of a pumping outfit; and the continual demands maintenance makes in the cleaning of drains and the pumping-out of the water must not be overlooked.

The establishment of swamp-grasses is not a costly or a laborious undertaking. As yet, very little of it has been done, and the great swamp-pastures of to-day owe very little to man for their presence. Beyond a little fencing, the expenditure of money entailed by the establishment of a wet swamp-pasture is practically nil. The establishment of *Poa aquatica* probably is accomplished most easily by collecting and sowing seed from these grasses as soon as floods have subsided sufficiently so that progress can be made on the swamps. Mercer-grass is best established by planting cuttings of the stolons or overground creeping stems as soon as these can be obtained, so that the grass is well established before winter comes. Planting will be most successful in portions of the swamps on which the soil is wet in the summer.

After all, the drainage or non-drainage of swamps is decided by the need of the farmer for winter or summer fodder. If not much dry land is available for winter feeding of stock, then drainage to make more dry land is probably the correct step to take. If the farm comprises for the main part dry land from which plenty of surplus hay and silage can be made, then the colonization of the swamp with grasses natural to these conditions may well appeal. To many, the non-drainage of these great areas is considered a great waste of potential production of farm-products. Yet these areas are the safety-valves of the great Waikato River. Too often has the close confinement of great rivers created problems through the silting and continued rise in the river-bed, the inevitable consequential flooding, and the loss of stock and property and risk of life.

THE PRESERVATION OF SILAGE.

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During recent years the work of Woodman, Amos and Williams, and others has demonstrated the values of the different types of silage. It has been shown that in England oat and tare silage can be classified into five groups, as follows :—

(*a*) Sweet dark-brown : Usually stack silage where air has access.

(*b*) Acid light-brown : Usually in silos made from moderately mature herbage allowed to wilt.

(*c*) Green fruity : Made in silo from less-mature herbage than above, without wilting.

(*d*) Sour : Made from immature and succulent herbage, without wilting, and saturated with rain.

(*e*) Musty : Black silage where presence of air has allowed growth of fungi.

Chemical analyses and feeding trials have shown that of the above types acid light-brown and green fruity silage are preferable in that they possess approximately the same digestibility and nutritive values as the materials from which they are made, and they do not suffer the changes and losses which occur in the dark-brown silage produced under high temperature or in sour silage.

Causes of Ensiling.

After storage chemical and biological changes are responsible for the conversion of vegetation to silage, and a knowledge of the changes is necessary to understand how the different types of silage arise. Three factors are suggested as the cause of these changes : (1) The respiration of the plant cells ; (2) the activity of plant enzymes ; and (3) the activity of bacteria.

RESPIRATION.

The plant cells live for some time after cutting, and the normal respiration utilizes a small part of the plant carbohydrate, which in combination with the oxygen of the surrounding air is converted to carbon-dioxide and water. This process is accompanied by a rise in temperature noticeable within the first hours of storing a crop. If sufficient air is present, as in a crop of low moisture content or where settling is slow, this initial temperature may rise to 120° F. or higher, at which point the cells are killed.

ENZYMES.

During this early period, and after the death of the cells, constituent enzymes are capable of acting on the complex substances of the plants, particularly the proteins, and causing a breakdown to simpler organic compounds such as amino-acids. This reduction of complex constituents closely resembles the process of digestion in animals, but it is doubtful if the process is advantageous in preserving the silage or increasing the nutritive value of the material.

BACTERIAL ACTION.

The activity of bacteria is the most important and by some authorities is considered the only agent by which silage is preserved. Preservation, in which deleterious bacteria are prevented from developing, is dependent on the production of a high lactic-acid content. Lactic-acid bacteria utilize the available plant carbohydrates, but where there is a deficiency of these compounds other bacteria develop and cause an excessive breakdown of plant nutrients, particularly of the proteins. Similarly where the herbage contains a large proportion of legumes, where excessive seepage leaches out the soluble carbohydrates or where very low temperatures exist, lactic-acid bacteria are retarded in their activity and other organisms predominate. In this way are formed the compounds considered objectionable, particularly acetic, propionic, and butyric acids, the last being characteristic of sour silage. The value of acetic acid is not fully understood. In the absence of adequate lactic acid, acetic acid may help to preserve the silage, but its presence indicates a breakdown of food material. Experiments on the food-value of acetic acid have given conflicting results, and, since excellent silage can be made without the formation of noticeable amounts of this acid, in the following experiments its presence has been considered as undesirable.

In recent years the principle that high acid content is necessary for silage preservation has been applied in the A.I.V. system, in which hydrochloric acid is added at the time of ensiling the crop. In this case extra precautions are required to exclude air in order to prevent the growth of moulds, and the addition of calcium carbonate is necessary when feeding the silage.

As indicated previously, green fruity silage is made from succulent herbage which after cutting is stored with a minimum of wilting. In New Zealand grass-pasture silage predominates, and an attempt is made to produce the above green fruity type. On an average farm, from three to six days are required for harvesting, which usually involves cutting in the morning and storing in the afternoon, or, where more labour is available, cutting and storing as continuous or alternating operations. Succulent herbage is preferred, and there is a tendency to form sour silage. During the last three years experiments have been conducted (1) to determine a practicable method of treating silage to prevent the formation of the sour type, and (2) to determine if good silage can be made from material normally considered over-mature for this purpose. The experiments have aimed at a rapid production of lactic acid, and for this purpose cultures of bacteria and sugars have been added to the material at the time of storing.

EXPERIMENTAL METHODS.

For the first trials 44-gallon petrol-drums were utilized, the herbage being weighted by a 7 in. layer of soil. Pipes for thermometers passed through the soil into the silage. These drums held approximately 220 lb. each, and six were used for each experiment, the solutions being sprinkled on the material during filling and tramping. In the second and third years of the experiments three hillside pits partly enclosed

by timber and each of ½ ton capacity were used to check the results obtained in the drums. The pits were similarly filled, treated, and tramped, and were weighted with a covering of from 8 in. to 10 in. of soil. Drainage was provided in both drums and pits. A minimum period of six weeks was allowed for the silage to mature, though the majority of the experiments were left from three to four months before examination. Chemical analyses of the silage could not be undertaken, and the results are based on the condition of the material and the presence of objectionable acids as indicated by odours peculiar to these acids.

The herbage used for the trials varied considerably, this being due partly to seasonal variations in growth and partly to the proportions of rye-grass, clover, or cocksfoot included in the mixtures; but for each experiment the material was thoroughly mixed so that each bin or pit received similar material. Usually the herbage was cut in the morning, turned if very succulent, and stored in the early afternoon.

The experiments included the testing of the following: Cultures of *Bacillus bulgaricus*, *Streptococcus thermophilus*, *S. lactis*, a cheese starter, whey, hydrochloric acid, and molasses. The first four were "set" in milk a few hours before use, and the whey was freshly run from cheese-vats. In all cases the control was treated with the same weight of water as the liquid used for each treatment.* In experiments 1 and 2, 3 lb. of liquid was used in each bin, but in the subsequent trials the amount was increased to 2 per cent. As shown in the table, molasses was used in every trial, as ½ per cent. addition in the bins and as 1 per cent. in the pits (see numbers 9, 11, 13, and 15).

Results.

In a few trials, 2, 3, 10, and 12, good silage resulted in all the bins, and the differences were only slight. In most trials the controls produced sour silage, due to the presence of large amounts of acetic and butyric acids, and in only one trial, 10, did the control give better silage than a treatment. Usually the controls were of a lighter colour, with a glazed leaf surface and a partially collapsed condition of the leaf tissues.

Bacillus bulgaricus.—Cultures of this organism are capable of high lactic-acid production, and, as the results indicate, improved the quality of the silage. There was a marked reduction in the formation of acetic acid and butyric acid, and very little change in the colour or texture of the material. An addition of ½ per cent. molasses resulted in further improvement with the production of a pleasant aroma. Cultures of *B. bulgaricus* are difficult to prepare in sufficient quantities for the use of farmers, but the trials have demonstrated the value of an active lactic-acid organism in silage preservation.

Streptococcus thermophilus, S. lactis, and Cheese Starters.—These cultures do not produce as high a lactic-acid content as *B. bulgaricus*, and the results did not justify many trials. They did not show the consistent

* A typical experiment was arranged as follows: (1) Control: Water, 4 lb.; (2) Water, 3 lb.; molasses, 1 lb. (3) Water, 3 lb.; *B. bulgaricus*, 1 lb. (4) Water, 2 lb.; *B. bulgaricus*, 1 lb.; molasses, 1 lb. (5) Water, 2 lb.; whey, 2 lb. (6) Water, 1 lb.; whey, 2 lb.; molasses, 1 lb.

improvement given by *B. bulgaricus*. When they were combined with molasses a slight improvement occurred, but this was probably due to the effect of the molasses alone.

Whey.—As shown in the table, whey was used in eight trials, in two of which it was compared with cultures of *B. bulgaricus*. Applications of ½ per cent. whey gave satisfactory results, and larger quantities up to 4 per cent. gave improvement in proportion to the amount added. The whey always reduced the formation of acetic and butyric acids, and, with the larger amounts, gave a bright, clean silage. The addition of molasses further improved the quality of the silage, though in combination with 4 per cent. whey the only added effect over whey alone was the formation of a pleasant aroma.

Molasses.—Molasses was used in every trial, and consistently gave better results than the controls. Molasses-treated silage usually had a pleasant odour, retained a freshly cut appearance, and when combined with *B. bulgaricus*, hydrochloric acid, or fresh whey reduced the objectionable acids and odours to a minimum. The additions were restricted to a maximum of ½ per cent. in the bins and 1 per cent. in the pits, since the cost of this sugar to farmers prohibits the use of larger quantities.

Acid.—In experiment 4, hydrochloric acid applied as 0·8 per cent. solution was compared with *B. bulgaricus* and molasses. The results demonstrated that, provided air is excluded, commercial acid gives an excellent method of preserving silage, but in the quantity tested very little better than *B. bulgaricus* plus molasses. The amount of acid added is below the theoretical quantity required to give the necessary acidity in the silage, but the cost of acid in New Zealand prohibits its use, since an application of 0·8 per cent. would mean an additional cost of approximately 4s. per ton of silage.

Material.—As indicated previously, the herbage used in the trials varied considerably, and the resulting silage as shown by the controls was similarly variable. The best silage prepared from untreated material was obtained from wilted succulent rye-grass mixed with white clover. The poorest silage was made from non-wilted succulent rye-grass or mixtures of coarse rye-grass and cocksfoot normally considered too mature for ensilage. These classes of material gave good silage when treated with whey, molasses, or *B. bulgaricus* plus molasses.

Temperatures.—A record of the temperatures obtained in the trials did not show any relation between temperature and treatment or conditions of the silage. The highest temperatures were recorded between the fourth and sixth days, but these rarely exceeded 90° F., the maximum temperature being 102° F.

Conclusions.

The quality of silage can be improved materially by the addition of lactic-acid organisms, hydrochloric acid, whey, and molasses. Of these treatments whey and molasses, alone or combined, are the best for farm practice in that they are the cheapest sources of sugars available and at the same time give excellent results when applied to many types of herbage.

Table summarizing Trials relative to the Curing of Silage.

Material.	Control.	Control plus Molasses.	Starter.	Starter plus Molasses.	*B. bulgaricus.*	*B. bulgaricus* plus Molasses.	*S. lactis.*	*S. lactis* plus Molasses.	*S. thermophilus.*	*S. thermophilus* plus Molasses.	Acid.	Acid plus Molasses.	Remarks.
1. Old rye-grass plus young rye-grass	Poorest	Fair	Poor	Poor	Good	Best	..	..	..	..	..	..	Control very sour.
2. Succulent rye-grass (wilted) ..	Fair ..	Fair	..	..	Good	Best	..	..	Fair	Fair	..	..	Control slightly sour.
3. Succulent rye-grass (wilted) ..	Fair ..	Fair	..	..	Good	Best	Fair	Fair	..	..	..	..	Control slightly sour.
4. Succulent rye-grass (wilted) ..	Poorest	Good	..	..	Fair	Good	..	..	..	..	Good	Best	Acid trials gave clean bright silage except around top sides.
5. Coarse, dry rye-grass	Poorest	Good	Fair	Good	Good	Best	..	..	..	..	..	..	Control sour.
6. Coarse, dry rye-grass	Poor	Good	Fair	Poor	Best	Fair	..	..	..	..	..	..	Bin 4 not treated top third.
	Control.	Control plus Molasses.	*B. bulgaricus.*	*B. bulgaricus* plus Molasses.	Whey ½%.	Whey ½% plus Molasses.	Whey 1%.	Whey 1% plus Molasses.	Whey 2%.	Whey 2% plus Molasses.	Whey 4%.	Whey 4% plus Molasses.	
7. Succulent rye-grass (wilted) ..	Poorest	Good	Fair	Good	Good	Best	..	..	..	..	..	..	Control an objectionable silage.
8. Coarse rye-grass plus white clover	Poorest	Fair	Fair	Good	..	..	Best	Good	..	..	..	..	Control mainly acetic.
9. ½ rye-grass plus ½ cocksfoot ..	Fair ..	Good	..	..	..	..	..	..	..	..	..	..	Pits: Control mouldy; molasses decidedly better.
10. Succulent rye-grass plus 20% white clover	Good	Good	..	..	Fair	Fair	Good	Best	..	..	..	..	Only slight differences—ideal material.
11. ½ succulent rye-grass plus cocksfoot	Fair ..	..	..	..	..	..	..	..	..	..	Good	Best	Cocksfoot slightly coarse; molasses improved aroma only over whey.
12. 2 succulent rye-grass plus 1 cocksfoot	Poorest	Good	..	..	Fair	Fair	1½% Good	Best	..	..	..	..	Differences not marked.
13. Succulent rye-grass plus white clover	Poorest	..	..	..	..	..	..	..	Best	Good	..	..	Control, objectionable acids.
14. Coarse rye-grass plus 15% coarse cocksfoot	Poorest	Fair	..	..	..	..	Fair	Good	Good	Best	..	..	Control, objectionable acids; Bin 6, pleasant aroma.
15. 3 rye-grass plus 2 succulent white clover	Poor	..	..	..	..	..	..	..	Good	Best	..	..	Control, bad aroma and appearance; molasses best aroma.

THE NORTH TARANAKI PASTURE COMPETITION.

REVIEW FOR SEASON 1934–35.

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THE judging of this competition organized by the joint committee representing the Taranaki Agricultural Society and the Farmers' Union has now been completed, and the following table showing entries from the various districts since the inauguration of the class in 1930 is an indication of the interest shown by farmers throughout the territory :—

TABLE OF ENTRIES.

District.	Season.				
	1934–35.	1933–34.	1932–33.	1931–32.	1930–31.
Urenui	23	24	22	17	10
Inglewood	11	6	2	12	17
Huirangi	..	8	7	12	11
Kaimata	4	4	3	11	6
Lepperton	14	8	9	7	4
Tikorangi	4	7	7	10	2
Okato	9	9	5	20	..
Toko	7	10	8	5	..
Tarurutangi	5	7	8	8	..
Wharehuia	17	15	16	..	..
Omata	..	3	4	..	..
Hurworth	..	..	2	..	..
Oakura	..	11	..	..	..
Hillsborough ..	..	3	..	..	..
Ngaere	10	..	..	..	..
Tariki	3	..	..	..	..
Totals	107	115	93	102	50

Each pasture entered in the competition was judged in the spring and again in the autumn, this procedure being generally regarded as the most sound and equitable method of awarding points on the basis of all-the-year-round production of feed and utilization and management of fields.

Judging was carried out by observation, and points were alloted on the same scale as last season—*i.e.*, good grasses, 30 ; clovers, 25 ; freedom from inferior grasses, 5 ; freedom from weeds, 10 ; denseness of sward, 15 ; evenness of sward, 15 : total, 100. A full explanation and definition of each of these subdivisions was presented in the report last year, and further experience has not provided any reason to make any alterations for the future, as the present method is proving as satisfactory as is possible under the very varied conditions which obtained throughout the territory.

In order to have the North Taranaki championship awards made under conditions as closely comparable as possible, it was decided that this season the first five pastures should be rejudged on the same day, but as there was so little difference between some entries the number was increased to eight.

While in many cases competitors entered only the best pasture on the farm, a number submitted entries of fields concerning which they were in doubt as to whether it would prove economical to renovate them by top-dressing and good management instead of ploughing and subsequently resowing them. While it is an honour to a district to have the winner of the open championship in its community, every encouragement should be given to those farming pastures of doubtful value as exemplified above to enter them and thus be enabled to secure from the result of the judging a definite opinion as to the success of the method of regeneration employed. In other words, this competition should be viewed in its widest sense as offering an excellent means of raising the standard of pastures and pasture management and utilization throughout each district, and this in North Taranaki generally. Great credit is due to those competitors who enter good pastures each season, as they have in most cases raised them to the present standard by their own effort and initiative, but where one must naturally look for the marked improvement in the future is from pastures lower down the championship list, usually on country in not such an advanced state of fertility, and where good methods must in time bring greatly increased carrying-capacity through the establishment and maintenance of better swards.

From information supplied by competitors the following useful data were obtained:—

Acreage of Paddocks.—The average size of all fields entered was 6·3 acres, the actual sizes being—3 acres, 9 fields; 4 acres, 18; 5 acres, 23; 6 acres, 17; 7 acres, 12; 8 acres, 11; 9 acres, 3; 10–15 acres, 11; 15–20 acres, 2; over 20 acres, 1 field.

These figures show clearly that the value of subdivision and controlled grazing is fully realized in the district, and it is obvious that in regard to this very important factor in increasing production farmers are making a real effort to follow practices which have proved profitable in other dairying districts.

Age of Pastures.—The average age of the pastures entered was 12·5 years shown individually as follows: 3 to 7 years old, 20; 7 to 10 years old, 33; 10 to 15 years old, 22; 15 to 20 years old, 15; over 20 years old, 17.

Pastures to be eligible for entry must be three years old, and the figures available emphasize the fact that in general most of the oldest pastures are among the best: the average age of the first ten this year was 12·6 years.

Time of Sowing.—Details were available in ninety-five instances, and of these seventy-nine were sown in the autumn and sixteen in the spring, while of the latter the majority were established in the inland districts.

Quantity of Seed per Acre.—This varied from 30 lb. to 65 lb. per acre, as shown by the following table :—

30–40 lb. per acre	20
40–44 lb. per acre	19
45–49 lb. per acre	20
50–54 lb. per acre	11
55–59 lb. per acre	3
60–65 lb. per acre	6

A study of these figures shows that about half the entries were sown at the rate of from 40 lb. to 50 lb. per acre, which can be regarded as being an economical and satisfactory seeding. As shown above, however, the average age of the first ten pastures was over twelve years, and details of seedings were not available in some instances. The opinion is expressed freely and is founded on experience in many districts that the only method of securing the necessary quick cover to control weed-growth and give the young pasture the best possible chance for forming a close sward is the sowing down with heavier seedings of from 50 lb. to 60 lb. per acre. It is possible, however, that two or possibly three very important factors have been overlooked by those who advocate heavy seedings and these are—(1) The thorough preparation of the land prior to sowing to cope with weed-growth ; (2) the higher standards of germination and purity of seeds now on the market ; and (3) the great importance of consolidation of the seed-bed and correct cover of the seed after sowing. Of these, the first two are obviously matters which easily can be agreed upon, as in the first instance the comparatively small cost of an additional working will be compensated for amply in the securing of a clean "strike," which is of the utmost importance in the later life of the pasture. In considering the second factor it must be admitted that where, say, rye-grass of known and proved type and over 95 per cent. purity and germination is used 1 bushel should be ample in a 45 lb. mixture. Consequently, with improvement in seeds, it is not necessary to sow additional seeds to offset useless material for a possible loss, and the heavy seedings should be unnecessary under good conditions. The third factor raises, however, what is possibly a very controversial matter, but one that can be judged readily by the farmer himself provided he keeps in mind the fundamental fact that seeds of grasses and clovers have much smaller reserves than do those of, say, beans and peas. The first requisite is of course the soil moisture, and this is available only on a firm seed-bed where capillary action is possible, and after germination the fine roots immediately seek plant-food in solution from the soil. This, of course, introduces the question of sowing fertilizers with the seed, a matter which will be discussed later. It seems that more than the present amount of consolidation common throughout the district should be employed, and the seeds should be covered to such a depth as to enable them to be in contact with soil-moisture and yet be as free as possible from depredations of birds. The open, friable soils predominating in the territory require more consolidation than was probably thought necessary in earlier times, and one reason why the older pastures still show up so well in comparison with later-sown ones may be due to the fact that rather poor "strikes" were secured and the present swards are the result of many years of

top-dressing and good management and utilization. It is a practice in some districts to drive sheep over the newly sown areas, and this is obviously an appreciation of the importance of consolidation, which in this instance is carried out by the mob, which gives hoof-cultivation as well as a firm seed-bed with the necessary cover for the seed.

Manure with the Seed.—Manure was sown in sixty of the seventy-nine entries. There was great variation, as shown by the following details: No manure, 19 entries; superphosphate, 32; Superphosphate plus lime, 8; Superphosphate plus bonedust, 5; Superphosphate plus basic slag, 1; bonedust, 3; proprietary, 8; blood and bone, 2; North African phosphate, 1.

In this connection it is evident that the importance of having readily available plant-food close to the young seedlings is realized fully, and the use of superphosphate on thirty-two sowings emphasizes this fact. It is possible that the addition of slag, lime, or either blood and bone or bonedust would have improved the position in giving an extended fertilizer effect, and the use of such mixtures is a practice in certain districts.

Subsequent Top-dressing.—The following table indicates the recent manurial treatment subsequent to sowing:—

Top-dressing.	1932.	1933.	1934.
Basic slag	30	17	9
Superphosphate	36	31	23
Lime plus superphosphate ..	19	21	22
Slag plus superphosphate ..	4	3	4
Slag plus potash	..	1	1
Phosful	5	2	2
Phosful plus superphosphate ..	1	..	..
Superphosphate plus blood and bone	1	2	3
Blood and bone	1	1	..
Ammoniated superphosphate ..	..	..	2
Slag plus ammoniated superphosphate	2	..	..
Superphosphate plus potash ..	2	4	8
Rock phosphates	..	2	5
Proprietary	6	9	19
No manure	..	7	9

The greatly decreased use of slag undoubtedly is due to the difference in price between it and other fertilizers in the present time of restricted finances for top-dressing, and the figures above are a remarkable example of how farmers are trying various straight manures and mixtures in an effort to replace economically one with which they were familiar through years of its application. It is obvious that superphosphate is forming the bulk of all mixtures to supply the necessary phosphate basis, but nitrogen in the form of the organic manures and also as sulphate of ammonia is being tried. Potash is also being tried in a number of cases, and in addition to the mixtures shown above it is a constituent

in most of those made up by merchants and included in the table under the heading "Proprietary." Lime plus superphosphate in the table includes proprietary manures which are combinations of these two top-dressings, and the addition of lime to superphosphate is becoming an increasingly popular farm practice in top-dressing. The use of nitrogen and potash is still in the investigational stage, although there are a number of successful farmers in the various districts who annually include potash in their top-dressing mixtures.

Quantity of Top-dressing applied.—This varied from 2 cwt. to 5 cwt. per acre, as shown below:—

Quantity per Acre.	1932.	1933.	1934.
2 cwt. ..	3	3	4
3 cwt. ..	84	82	76
4 cwt. ..	17	13	12
5 cwt. ..	3	2	6

Quantities up to 3 cwt. per acre were applied in one dressing, while those over 3 cwt. were in most cases top-dressed half in the autumn and half in the spring. The practice of making two applications is gaining favour, and it seems as if it will become the regular method as financial conditions improve.

Types of Harrows used.—The importance of harrowing in good pasture-management is obviously recognized, and, while there is not much definite knowledge available on the subject, the fact that only seven competitors entered areas which had not been harrowed is significant. It is advisable to harrow with some form of implement to spread droppings, but there is not a great deal of information available on the subject of root-pruning and soil-aeration in the well-established sward. The makes of harrows used by the entrants were—Tripods, 34; Burke, 17; chain, 11; Whakatane, 10; Taylor, 7; chain and tine, 7; Reid and Gray, 4; Evona, 3; Wilson, 2; Wright-Stephenson, 2; Duncan, 1; Alfa, 1; Massey, 1.

More than half of the areas entered were harrowed with a tripod or modification of this type of flexible implement, and quite good work is performed by such types. It would appear that the use of the heavier and more severe types is largely governed by the condition of the sward and whether it is proposed to follow the operation by the inclusion of pasture-seeds in the top-dressing mixture and subsequent rolling. When seed is distributed the harrowing associated with this is scarcely harrowing in the generally accepted use of the word: it is actually a method of surface cultivation by which a more or less deteriorated pasture is improved by use of the harrowing and the seed-sowing. The question of the drastic harrowing of a close sward of highly productive pasture-plants is extremely controversial, and is the subject of investigation. The following details show the number of times the various pastures were harrowed: 1 stroke, 24 entries; 2 strokes, 34; 3 strokes, 13; 4 strokes, 15; 5 strokes, 7; 6 strokes, 6; 7 strokes, nil; over 7 strokes, 1; no harrowing, 7.

Carrying-capacity.—As an example of how the smaller farms under more intensive management compare with larger areas on which less care and attention can be given to each acre, the following figures, which indicate the number of acres required per cow on farms of various sizes, and which can be regarded as representative of the whole territory, are interesting: Up to 50 acres, 1·81 acres per cow; 51 to 75 acres, 1·97; 76 to 100 acres 2·03; 101 to 150 acres, 2·11; over 151 acres, 2·13.

The following shows the carrying-capacity on farms of competitors, and illustrates the fact that the field entered in the competition does not necessarily receive special treatment but is typical of the pastures farmed: Competitors securing over 180 points, 1·56 acres per cow; 175 to 179½, 1·93; 170 to 174½, 2·07; 165 to 169½, 2·39.

The champion pasture for the season was the No. 1 entry of Mr. W. F. Goodin, Okato, which was awarded 184 points. It was 7¾ acres in area and nine years old, sown in the autumn with 60 lb. of seed per acre. It was top-dressed in 1932 and 1933 with basic slag at 3 cwt. per acre and last season had the same amount of guano. The pasture was harrowed six times with the tripod and chain, and was topped in the 1932 and 1933 seasons. Rye-grass and white clover were dominant in the sward, with timothy and a small proportion of paspalum, and the denseness and evenness of the sward were outstanding. Mr. Goodin entered two other fields, which were also high up in the district list, showing that the standard of pasture on his farm is high. The champion field secured second place last season, and grazes 120 cows when being fed off.

Mr. J. N. Blyde, Lepperton, secured second place with a field 3½ acres in area, which was awarded 182 points, and which is over twenty years old. It has been top-dressed twice each year, as follows (quantities per acre): 1932, 2½ cwt. superphosphate in the spring and 3 cwt. calciphos in the winter; 1933, 2½ cwt. superphosphate and 1½ cwt. 30 per cent. potash in spring and 5 cwt. lime, 2½ cwt. superphosphate, and 2 cwt. 30 per cent. potash in winter; while last season it received 2 cwt. superphosphate and 1½ cwt. 30 per cent. potash in spring followed by 4 cwt. lime, 2½ cwt. superphosphate, and 1¼ cwt. 30 per cent. potash in winter. This pasture was awarded highest honours in the autumn judging in the whole territory, and is dominant rye-grass, white clover, with timothy and cocksfoot, the whole sward being dense and even and remarkably free from weeds. It was harrowed three times with the Burke implement, and was topped once during the season.

Mr. J. H. Paulger, Tikorangi, was awarded third place with a twelve-year-old pasture of 4 acres sown in the autumn with 40 lb. of seed and 3 cwt. of superphosphate per acre. This entry secured 181 points, and the dense, even sward consisted of rye-grass, cocksfoot, and white clover, with a small percentage of paspalum and crested dogstail. In 1932 it received superphosphate 3 cwt. with 1 cwt. 30 per cent. potash; 1933, 2 cwt. superphosphate and 1 cwt. 30 per cent. potash; and last season as in 1933. It was harrowed twelve times during the season with a Wright-Stephenson harrow, and was topped once. This entry was second highest in the autumn judging.

Mr. G. Downes, Wharehuia, secured fourth position with his entry in the open class, a 5-acre field nine years old, sown in the autumn with 50 lb. of seed and 3 cwt. proprietary grass manure per acre. It was top-dressed in 1932 with basic slag 3 cwt.; 1933, calciphos, 3 cwt.; but no fertilizer was applied last season. The pasture is dominantly rye-grass, cocksfoot, and white clover, with a small percentage of rib-grass and dandelion, and was harrowed twice with tripod and chains and cut for hay.

SWEDE AND TURNIP VARIETIES.

THEIR DESCRIPTION AND DISTRIBUTION IN NEW ZEALAND.

J. W. Hadfield and R. A. Calder, Agronomy Section, Plant Research Station, Palmerston North.

The area devoted to the swede and turnip crop in New Zealand amounts to over 400,000 acres and is therefore greater than that devoted to any other arable crop. In this review an attempt is made to define the relative importance and ecological adaptability of the main varieties as indicated by the area devoted to each. This has been possible only through the co-operation of Fields Superintendents and Agricultural Instructors attached to the Fields Division, who have answered a questionnaire designed to supply the information required. Acknowledgments and thanks are here accorded to all those who have co-operated.

Secondly, an attempt is made to describe the more important varieties and to group them, and opinions are expressed in regard to synonymity. Synonymous varieties should be so alike in both appearance and performance that they can be regarded with no hesitation as the one agricultural variety. This is not easy in a self-pollinated crop, and in one that is cross-pollinated, such as swedes or turnips, the difficulty becomes greater owing to variation. Moreover, it is to be expected that differences will be apparent among the distinct stocks of any one variety that have been raised by different firms or breeders or seed-growers. These differences are sometimes slight or of no apparent agronomic importance. Nevertheless it becomes difficult to assign the particular degree of variation that shall be sufficient to warrant recognition of varieties in such work as this.

Physiological differences are still more difficult to define and yet are far more important, involving as they do such important matters as disease-resistance, yield, chemical composition, and ecological considerations.

Synonymity has therefore proved to be a very difficult matter, and, despite the fact that statements herein are based on three years' observations at this Station, and for a lesser period in Southland, they are by no means conclusive. For convenience of description varieties are grouped according to morphological characters, but varieties in any

one group, although so closely approximating one another in appearance as to defy differentiation, may be widely dissimilar in other respects, as, for example, Bruce and Purple Top Yellow Aberdeen, Wallace and Green Top Yellow Aberdeen. On the other hand, varieties of widely different appearance may prove to be very similar in other respects, as in the case of Hernings and Wilhelmsburger Otofte.

FIG. 1.

a (top), Garton's Superlative; *b* Sutton's Superlative; *c* Webb's Masterpiece; *d* Garton's Superlative sold under the name Grandmaster.

Note the distinct type of Sutton's Superlative.

In the varietal descriptions much assistance was rendered by Mr. R. B. Tennent, Director of the Fields Division, who was then Fields Superintendent for Southland and Otago, and by Mr. J. O. Wallace, of the Department of Agriculture, Dunedin, who corroborated by plot trial those observations made at this Station.

In collecting material for the illustrations an attempt has been made to select typical roots which show, to some extent at least, the range of variation within each variety. They cannot be regarded as exhibition roots. The photographs are by Mr. H. Drake.

For the purposes under review the Dominion has been subdivided as follows :—

District defined.	Short Title used in Table.
Southland west and south of a line joining Mossburn and Edendale	West Southland.
Eastern Southland and part of Otago extending to Kelso	East Southland.
Clutha, Bruce, Taieri, Waikouaiti, Peninsula, and part of Tuapeka Counties	Mid and South Otago.
Central Otago, west of Middlemarch	Central Otago.
North Otago: Palmerston South to the Waitaki River	North Otago.
Canterbury, south of Rangitata River	South Canterbury.
Canterbury, between the Rangitata and Rakaia Rivers	Mid-Canterbury.
Canterbury, north of Rakaia River	North Canterbury.
Marlborough Province	Marlborough.
Nelson Province	Nelson.
Horowhenua, Oroua, Manawatu, Kiwitea, Pohangina, and Woodville Counties	Manawatu.
Woodville to East Coast and south	Wairarapa.
South Taranaki, east of Patea River	South Taranaki.
North Taranaki, west of Stratford	North Taranaki.
Rangitikei, Waimarino, Waitotara, and Wanganui Counties	Wanganui.
Hawke's Bay and Poverty Bay Provinces	Hawke's Bay and Poverty Bay.
Bay of Plenty district	Bay of Plenty.
Putaruru, Rotorua, Takoroa	Central Plateau.
Waikato, Waipa, Raglan, Otorohanga, Waitomo, and north Matamata Counties	Waikato and King-country.
Manukau Harbour, south to Taupiri Range	South Auckland.
North Auckland Peninsula, north of Manukau Harbour	North Auckland.

Distribution of Swedes, Yellow Fleshed and White Fleshed Turnips.

Table 1 has been prepared from replies received to the questionnaire submitted to Instructors in Agriculture. In this table, as in others to follow, the figures are estimates prepared by those best able to judge the proportionate area devoted to each variety from a knowledge of the district and inquiries from seed-merchants as to the quantity of seed sold.

It will be seen from the table that of the total area of crop 45·5 per cent. is devoted to swedes, 17·2 per cent. to yellow-fleshed turnips, and 37·3 per cent. to white-fleshed turnips. It shows also their relative importance in the twenty-one districts into which the Dominion has been divided for the convenience of this review.

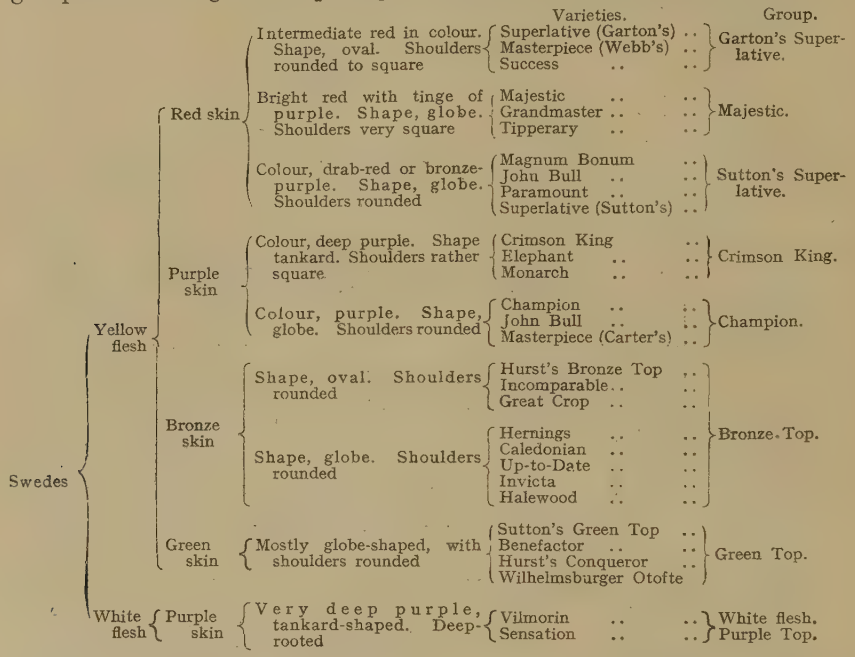
TABLE 1.—DISTRIBUTION OF SWEDE, YELLOW-FLESHED TURNIP, AND WHITE-FLESHED TURNIP AREAS IN NEW ZEALAND.

	Total Area of Swedes and Turnips.		Acreage in each District devoted to			Percentage in each District devoted to		
	Acres.	As Percentage of Dominion Average.	Swedes.	Yellow-fleshed Turnips.	White-fleshed Turnips.	Swedes.	Yellow-fleshed Turnips.	White-fleshed Turnips.
Total area covered by return	427,750	*	194,850	73,550	159,350	45·5	17·2	37·3
Western Southland	50,000	11·7	31,000	16,500	2,500	62	33	5
Eastern Southland	52,000	12·1	26,000	18,300	7,700	50	35	15
Mid and South Otago	42,000	9·8	16,800	12,600	12,600	40	30	30
Central Otago	6,500	1·5	400	4,650	1,450	6	72	22
North Otago	11,000	2·6	2,200	900	7,900	20	8	72
South Canterbury	49,000	11·4	24,500	4,900	19,600	50	10	40
Mid-Canterbury	38,800	9·1	3,500	3,500	31,800	9	9	82
North Canterbury	39,500	9·2	3,950	3,950	31,600	10	10	80
Marlborough	2,900	0·7	300	300	2,300	10	10	80
Nelson	4,000	0·9	600	400	3,000	15	10	75
Manawatu	10,100	2·4	4,400	1,000	4,700	44	10	46
Wairarapa	9,000	2·1	3,300	200	5,500	37	2	61
South Taranaki	6,850	1·6	3,750	1,050	2,050	55	15	30
North Taranaki	11,600	2·8	7,200	1,150	3,250	62	10	28
Wanganui	34,000	8·0	19,700	700	13,600	58	2	40
Hawke's Bay and Poverty Bay	4,000	0·9	3,000	300	700	75	7	18
Bay of Plenty	3,700	0·9	2,250	200	1,250	60	6	34
Central Plateau	2,700	0·6	2,400	100	200	90	3	7
Waikato and King-country	38,300	9·0	35,200	1,550	1,550	92	4	4
South Auckland	4,000	0·9	1,300	500	2,200	33	13	54
North Auckland	7,800	1·8	3,100	800	3,900	40	10	50

* The Government Statistician reports for the season 1933–34, 414,911 acres turnips and 63,741 acres turnips and rape mixed.

Swede Varieties.

Of the many swede varieties grown under trial only those at present of economical importance in New Zealand are mentioned. They are grouped according to morphological characteristics as follows:—



In the above classification of shape, and in those of turnips to follow, the system adopted has been—

Tankard: Length twice the width.
Oval: Length one-and-a-half times the width.
Globe: Length and breadth equal.
Flat: Length less than breadth.

GARTON'S SUPERLATIVE GROUP.

Varieties: Garton's Superlative (Fig. 1*a*), Webb's Masterpiece (Fig. 1*c*), Success.

The leaf mid-rib and stalk are pale purple and green. Skin colour is an intermediate red with a decided gloss. In shape the root is oval, with shoulders that vary from rounded to square. Flesh is yellow. Samples sent in for trial contained an occasional bronze top, but otherwise were very pure and uniform. All lines branded "Masterpiece" (Fig. 1*c*), (except Carter's Masterpiece) were indistinguishable from Garton's Superlative, and may be regarded as synonyms, and of eight lines of Grandmaster three had to be classed as Superlative (Fig. 1*d*). Superlative sold under the description "Sutton's" (Fig. 1*b*) is distinct in shape and colour from that sold under the description "Garton's," and the former has therefore been included elsewhere—namely, in the Sutton's Superlative group.

Superlative has been for many years, and still is, the most popular and widely grown variety. To what extent Garton's or Sutton's Superlative respectively has been responsible for this record cannot be ascertained, but since in many trials conducted in the past Garton's has been specified, and as this type and other varieties very similar to it (Masterpiece and Grandmaster) dominate the position at the present time, it may be surmised that the Garton's type is the more popular, representing as it does over 22 per cent. of the total area in swedes.

FIG. 2.

a Grandmaster ; *b* Majestic ; *c* Tipperary.

In departmental trials conducted about 1911 Garton's Superlative is recorded as being decidedly resistant to club-root, but this resistance has not been maintained in recent years, and at the present time the variety can by no means be regarded as having any special merit in this respect. On the other hand, in nearly all trials it is reported to have been more severely infected with dry-rot than other varieties. It is not possible to say whether this high infection has been due to varietal susceptibility or to the imported seed being more highly infected than other varieties, or to both causes. It is true, however, that, despite

these weaknesses, Garton's Superlative has taken a leading place in yield trials and in agricultural shows throughout the Dominion. Little is known of the variety "Success" except that in these trials it could not be distinguished from Garton's Superlative. Masterpiece and Garton's Superlative together represent approximately 36 per cent. of the New Zealand swede crop.

MAJESTIC GROUP.

Varieties: Majestic (Fig. 2*b*), Grandmaster (Fig. 2*a*), Tipperary (Fig. 2*c*).

Foliage a medium green with a slight bluish tinge, mid-rib and stalks green, tinged with reddish-purple. Skin colour a bright red with a purplish tinge. Globe-shaped, with very square shoulders. Flesh yellow.

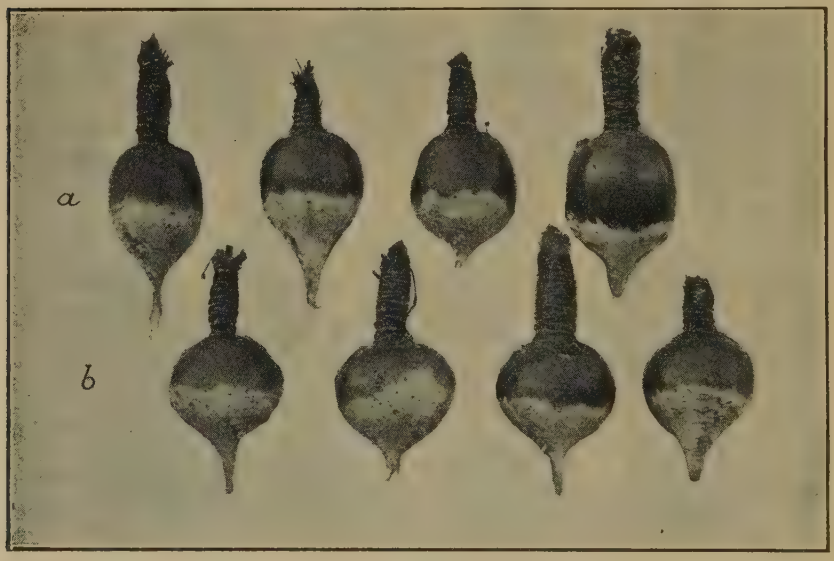


FIG. 3.

a and *b*: Two types of Magnum Bonum were included in the samples collected for trial.

In all trials, both here and in Southland, it has not been possible to differentiate between Majestic (Fig. 2*b*) and Tipperary (Fig. 2*c*). They are not grown as extensively as would seem to be warranted from the results of these trials, in which they were outstandingly promising, and the few yield trials in which they have been included support this view. The group has been termed "Majestic" because this variety typifies the group far better than Grandmaster. It is, in fact, questionable whether Grandmaster (Fig. 2*a*) should not be included in the Superlative group (Fig. 1) rather than in the Majestic group since certain of its characteristics place it between the two.

Grandmaster is increasing in popularity, more particularly in the southern portion of the South Island, where it is competing with Garton's

Superlative for supremacy. It is deservedly popular and an excellent variety. The group represents about 12 per cent. of the total area in swedes, Grandmaster alone being responsible for over half of this.

SUTTON'S SUPERLATIVE GROUP.

Varieties: Magnum Bonum (Fig. 3), Sutton's Superlative (Fig. 1*b*), John Bull, Paramount, Challenge Pioneer.

Foliage medium green with a faint bluish tinge, stalks and mid-rib tinged with reddish-purple. Colour is an intermediate red to bronze-purple or drab red. Shape, globe. Flesh yellow.

Sutton's Superlative is the most important variety in this group. Although in the estimate of areas devoted to different varieties an attempt is made to differentiate between Sutton's and Garton's Superlative much reliance cannot be placed upon these figures. Merchants and growers are for the most part unaware that any difference exists. Magnum Bonum is rapidly being replaced by newer productions, while in the sample submitted for trial John Bull was of two types, those not included here falling into the Champion group. The variety is, however, relatively unimportant. Paramount and Challenge Pioneer are tentatively included in this group. Little is known of them, and their distribution is insufficient to warrant their inclusion in the tables.

(To be continued.)

THREE FUNGI CAUSING "BROWN-PATCH" OF LAWNS IN NEW ZEALAND.

R. M. BRIEN, Mycological Laboratory, Plant Research Station, Palmerston North.

FOR a number of years a disease known as "brown-patch" has been prevalent in bowling and golf greens and lawns in various parts of New Zealand. The object of this article is to record that the following fungi have been isolated from diseased turfs forwarded from the various centres.

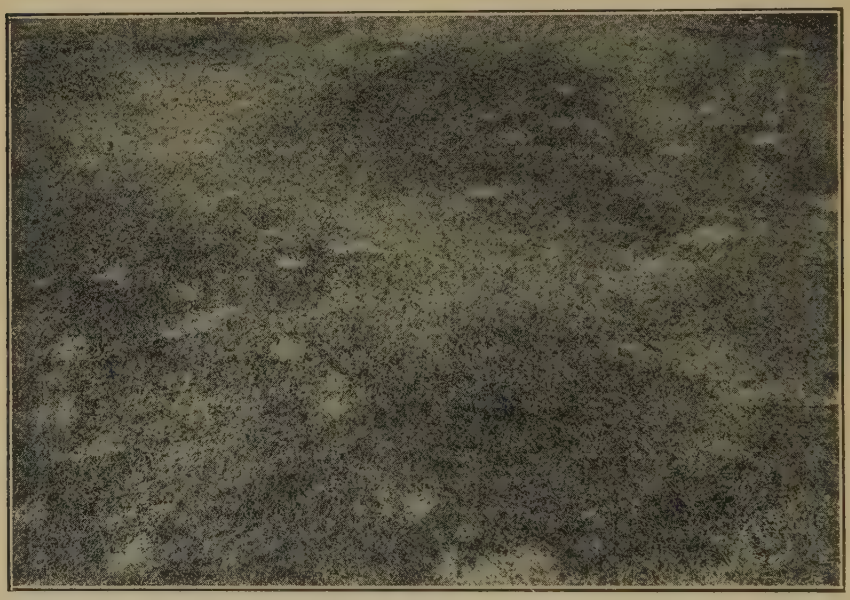
(1) *Sclerotinia trifoliorum* Erikss.—This fungus is the cause of stem and root rot of clovers and lucerne, and is prevalent in Europe(1), England, and the United States of America, both on these and other members of the Leguminosæ. *S. trifoliorum* was first isolated from playing-greens in New Zealand in 1932. Since then infected turfs have been obtained from putting-greens at Rotorua and Pukekohe (these consisting mainly of *Hydrocotyle* sp.), from bowling-greens at Wellington and Auckland, and from a croquet-lawn at Masterton. This last-mentioned green had been sown down mainly with suckling-clover (*Trifolium dubium*).

The disease appears as small circular patches from 6 in. to 8 in. in diameter, in which the turf first turns yellow, then brown, and finally dies out. These patches generally occur irregularly over the whole surface of the green.

(2) *Corticium vagum* Berk et Curt.; Synonym = *Rhizoctonia solani*, Kuhn.—A disease of lawns and playing greens due to a strain of

Corticium vagum, and known as "large brown-patch," has been prevalent in the United States of America for a number of years. It was first recorded in 1919 by Piper and Coe(2). In New Zealand during the past three years a strain of this fungus has been associated with similar symptoms. Cultures have been obtained from specimens of infected turfs from bowling and golf greens at Hamilton, Auckland, Gisborne, and Dunedin.

The disease appears firstly as small, circular brown areas (2 in. to 3 in. in diameter), which gradually increase in size, often attaining a



PATCHES CAUSED BY THE FUNGUS CORTICIUM FUCIFORME ON THE GREENS RESEARCH AREA, PALMERSTON NORTH.

[*Photo by E. A. Madden.*

diameter of approximately 2 ft. These patches are scattered throughout the green, and sometimes coalesce, forming diseased areas up to 6 ft. in diameter. The grass on these areas turns brown and eventually dies, leaving bare places over the green.

(3) *Corticium fuciforme* (Berk.) Wakef.; Synonym = *Hypochnus fuciforme* (Berk.) McAlp.—The disease known as "red-thread," caused by the fungus *Corticium fuciforme*, has been present for some years both in Australia and New Zealand. In New Zealand the fungus was first collected in 1920 on *Lolium multiflorum* growing in the Hawke's Bay District. Since then *C. fuciforme* has been isolated from diseased patches on lawns, bowling and golf greens in the Hawke's Bay, Wairarapa, Manawatu, and Nelson districts.

The "red-thread" disease (see illustration) first appears as small, irregularly-shaped, light-brown patches measuring approximately 2 in. to 3 in. across. A characteristic feature of this disease is the red thread-like growth of the fructifications of the fungus, which project from the

foliage of the sward. These fructifications are usually present on grasses attacked by *C. fuciforme*. The fungus spreads rapidly through the green, leaving patches varying in size from 6 in. to 10 in. across, in which the turf dies out.

The three fungi recorded above overwinter in the soil, and, when warm, humid atmosphere conditions prevail, attack the lawn-grasses, producing symptoms as described above.

Remedial Measures.

Where greens have become infected with any one of the above fungi, further spread of the disease may be checked by the application of mercuric chloride solution, 3 oz. to 50 gallons of water, this being sufficient to treat 2,000 square feet of lawn. This treatment has been successfully applied to bowling-greens at Hamilton and also to putting-greens and plots on the Greens Research Area, Palmerston North. Treatments on the Greens Research Area were carried out in conjunction with Mr. E. A. Madden, of the Department of Agriculture.

Literature cited.

(1) Nilsson, —; Leissner, G.; and Sylven, N.: Studier over Kloverrotan (Sclerotinia trifoliorum). *Sveriges Utsadesforenings Tidskr.*, Vol. XXXIX, pp. 130–158; 1929.

(2) Piper, C. V., and Coe, H. S.: Rhizoctonia in lawns and pastures. *Phytopathology*, Vol. 9, pp. 89–92; 1919.

CYANOGLUCOSIDES IN WHITE CLOVER.

B. W. Doak, Plant Research Station, Palmerston North.

Much has been heard recently concerning the effect of white clover on animal-health and on "feed flavour" in dairy-products. The question about the relationship of the troubles experienced to the presence of cyanogenetic glucosides in the white-clover plant naturally arises.

Following on the qualitative observations by overseas workers that a certain strain of white clover—namely, Kentish wild white—contained a substance capable of liberating prussic acid (hydrocyanic acid), the writer investigated the quantitative aspect and found that the various white-clover strains contained varying amounts of potential hydrocyanic acid. This hydrocyanic acid is not present in the plant in the free state, but is in a combined state as a cyanogenetic glucoside from which the free acid is liberated by enzyme action. As the result of work with the Agrostological Section of the Plant Research Station a definite correlation was found to exist between the strain or type of white clover and the potential hydrocyanic-acid content. The results obtained during the first two years' investigations were published in the *New*

Zealand Journal of Science and Technology, Vol. XIV, pp. 359–365, 1933. Summarizing these results, the range of variation within the types was as shown in the following table:—

TABLE 1.—SHOWING RANGE IN POTENTIAL HYDROCYANIC-ACID CONTENT OF VARIOUS STRAINS.

Type.	Hydrocyanic Acid in Green Herbage. Per Cent.
New Zealand mother (type 1) ..	0·0070–0·013
New Zealand permanent pasture ..	0·0030–0·007
Kentish wild white	0·0040–0·006
New Zealand ordinary	0·0010–0·003
Dutch	0·0005–0·001

Results obtained in subsequent years show that the potential ydrocyanic-acid (HCN) content during the 1932–33 season was somewhat higher than has been found since. Few samples have been ound to contain more than 0·010 per cent. HCN, and the general range, especially in respect to the types higher in HCN, is lower than is shown in the above table. For certification purposes a new standard has to be set each season by reference to control lots the performance of which is known. During the past season the lower HCN limit of those lines certified as mother-seed lines has been in the vicinity of 0·005 per cent.

It is obvious from the above statements that some seasonal variation in HCN content is likely to occur, but during the last two seasons little variation has been observed. There is a tendency towards very slight increase in potential HCN towards evening as against other times of the day, but the results obtained over a fairly lengthy period are inconclusive. In all investigations into seasonal variation it is important to have homogeneous material with which to work as some plants are likely to vary in their relative herbage-production at different times of the year. The homogeneous material on which work was carried out was secured from a single plant of white clover increased by division to give a plot sufficient for the analysis of the herbage over a period.

White clover is the only pasture-plant reported in New Zealand as containing more than negligible traces of cyanogenetic glucosides, though Yorkshire Fog (*Holcus lanatus*) has been reported in America as liable to contain amounts likely to cause trouble to stock. It is well known that many other plants, such as sorghum (*Sorghum vulgare*) and Sudan-grass (*Sorghum sudanense*), contain large amounts of cyanoglucosides, and these though recognized as valuable fodder-plants have to be fed judiciously.

With sorghum wilting during hot, dry weather gives rise to abnormally high amounts of HCN, but wilting following cutting of the herbage allows the HCN to pass off, and in this condition the herbage becomes suitable for stock. White clover gives off its HCN on drying the cut material, but during the very hot, dry weather experienced at the beginning of the year no abnormally high amounts of HCN were recorded, rather the tendency was in the reverse direction.

There is no evidence that the amounts of HCN liable to be produced by the best strains of white clover in New Zealand are sufficient to cause any stock-poisoning. In fact, sheep and cattle have been

repeatedly grazed on almost pure stands of high HCN white clover at Palmerston North and in localities where the New Zealand No. 1 type of white clover is known to exist without any effect on the stock, and even when other low-testing white clover or grasses are available the stock usually show preference for the high-testing clover. Slugs and rabbits, however, appear to favour the low HCN testing clover rather than the high. Various calculations have been published regarding the amount of potential HCN it is necessary for an animal to eat before death from poisoning or symptoms of poisoning are observed. In most cases this calculation has been made on the basis of the lethal dose or the toxic dose of free hydrocyanic acid or potassium cyanide. This has led to erroneous conclusions, as "free" HCN and salts of HCN are quite different in effect from "potential" HCN. With the free acid the animal can absorb all the poison practically immediately, but with HCN fixed as a glucoside the free acid has to be liberated first as the cyanoglucoside in itself is not a poison. The liberation of HCN from a cyanoglucoside is often comparatively slow. The animal has the capacity of rapidly removing small amounts of HCN from its system through the breath or through the skin, and in this way can deal with quite large total amounts of HCN provided it is not given off too rapidly from the feed consumed. A certain amount of the HCN taken is converted into thiocyanates, which are relatively non-toxic. The rate at which HCN is liberated in the animal's body depends on (1) the amount consumed, (2) the rapidity of eating, (3) the amount present of enzyme necessary for the breaking-down of the glucoside, (4) the time taken for the material eaten to come into contact with acid digestive juices (HCN is more rapidly liberated in an acid medium than in an alkaline one), and (5) the presence or absence of substances inhibiting the liberation of the HCN (feeds rich in carbohydrates, especially glucose, and cellulose are known to retard the production of HCN).

Seddon, in New South Wales, reached the following conclusions as a result of a great deal of work. The minimal lethal dose of a cyanogenetic plant is that quantity of the plant which contains cyanogenetic glucoside, the HCN equivalent of which is equal to the fatal dose of HCN for an animal; this depends, however, upon the presence in the rumen of appropriate enzyme in sufficient quantity. The minimal percentages of HCN which should be considered dangerous for sheep are (*a*) in fresh plant, 0·02 per cent. and (*b*) in air-dried plant, 0·05 per cent.

This "minimal" dose is based on the assumption that all the potential HCN is liberated comparatively rapidly. It is possible, of course, that the feeding of plants containing more than 0·02 per cent. of potential HCN may not produce lethal effects due to possible insufficiency of enzyme or to some retarding effect of the contents of the paunch on the splitting of the glucoside. It may be taken with safety that a plant containing appreciably less than 0·02 per cent. HCN is very unlikely to produce death of the animal. The toxic dose is less than the lethal dose and is the quantity which will produce symptoms of poisoning but does not produce death. Chronic HCN poisoning is not recognized to exist, the poison not being cumulative.

From observations at Palmerston North it is obvious that white clover containing 0·013 per cent. potential HCN is not toxic.

Certain authorities consider that small quantities of cyanoglucosides, far from being a danger, are, in some cases, of definite condimental value. With reference to linseed-cake, which contains potential HCN, it has been stated: "It may well be that it owes its superiority to this small amount of HCN."

It has been suggested that bloating of animals on white clover may be associated with the HCN content. There is no evidence that high-testing white clover is any more likely to cause bloating than is Dutch white, which contains only very small amounts of cyanoglucoside. The writer, while testing clovers for HCN, observed that Dutch white clovers tended to evolve gas more rapidly than any of the other strains when allowed to digest with water in a closed flask at about blood-temperature. This observation in no way supports the contention referred to, nor does the fact that red clover, lucerne, and various other fodders contain no cyanoglucosides, yet these are very apt to cause bloat. It is well known that bloating is most frequent during the spring and in the autumn, but observations have shown that the HCN content of white clover at this time of the year is no greater than at other times. The highest figure for HCN content recorded in five years at Palmerston North was obtained at the end of January. It is conceivable, however, that when an animal is badly bloated, normally sub-toxic amounts of HCN may be sufficient to cause death.

M'Candlish, in Scotland, considers that bloating is associated with a high saponin-content and makes the observation that the saponin-content of Kentish wild white clover varies directly with the cyanoglucoside-content. This relationship apparently does not hold with New Zealand white-clover strains as these contain approximately the same HCN content at all times of the year, so that the saponin-content, by analogy, should remain at a constant level. If this is so, it would be expected that bloating should be common at all seasons.

As non-cyanophoric plants such as red clover and lucerne are known to produce "feed flavours" in cream similar to that produced by white clover the obvious inference is that HCN is not connected with the development of these flavours.

The information available, while possibly not absolutely conclusive, does not indicate that any stock trouble is associated with the cyanophoric nature of the strains of white clover being developed in New Zealand.

It is hoped to continue the investigations this coming season.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 8th August, 1935, to 22nd August, 1935, include the following of agricultural interest:—

No. 73021: Fertilizer-distributor; H. B. and L. H. Taylor. No. 73147: Fertilizer-distributor; *cognate with* No. 73021 above. No. 73214: Can-washing means; A. D. Littlejohn. No. 74049: Hay-sweep; A. C. Anderson. No. 74058: Harvesting-device; A. C. and W. G. Brenner. No. 74156: Harrow; J. H. and J. T. Young. No. 74183: Removal of honey from metal container; J. F. G. Roberts. No. 74290: Tobacco-manufacture; American Machine and Foundry Co.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

EFFECT OF LIMING LEMON-TREES AT TAURANGA.

SUMMARY OF INTERIM RESULTS COVERING FIRST FOUR YEARS OF EXPERIMENT.

W. K. DALLAS, Citriculturist.

EXPERIMENTAL plots were laid down in the orchard of Messrs. Mayfield Bros., Bethlehem, Tauranga, on 26th September, 1930. The object of these was to determine the effect of carbonate of lime used with a complete fertilizer. Each plot consisted of five trees, the plots being separated by buffer rows. There were four replications of each treatment. The variety of tree chosen for the test was "Lisbon" on "Sweet Orange" stock. The trees were planted in the autumn of 1921. They were then two years from the bud. The trees were planted 20 ft. apart on the square. The soil is of a light pumice type and the area flat.

Manurial Treatment.—Since the experiment was laid down all the plots have received the following dressings—(1) No lime; (2) carbonate of lime as follows: 2 tons per acre on 26th September, 1930, and 1 ton per acre on 22nd July, 1932. Both treatments were supplemented by annual dressings of superphosphate 6 cwt., sulphate of ammonia 6 cwt., and sulphate or muriate of potash 3 cwt. per acre. In the winter of 1934 carbonate of lime at the rate of 46½ lb. per tree was applied to both treatments in order to correct any increase in soil acidity caused by the sulphate of ammonia which had been previously applied. This dressing was based on an application of 1½ lb. lime for each 1 lb. of sulphate of ammonia.

Range of Distribution of Fertilizer Applications.—The fertilizers and lime were distributed evenly over the whole area of the respective plots right up to the trunk line of buffer trees, with the exception of an area having a radius of 4 ft. around each "plot" and "buffer" tree.

Green Manures.—Prior to the commencement of the experiment white lupins had been sown each autumn and disked under in the spring. On the 17th March, 1931, the whole area was sown with blue lupins. No difference between the lupin crops on limed and unlimed areas was noted. The crop was 18 in. in height and practically free from disease when disked in on 24th September. Blue lupins sown on 11th April, 1932, made only medium to light growth, due to frost injury, and were ploughed under in October. In the 1933 and 1934 seasons no cover crop was sown, but there was a heavy crop of weeds, which was disked under at each spring cultivation. The weed-growth was noticeably much heavier upon the limed than on the unlimed plots.

Soil Acidity.—The results of analysis of soil taken on 21st July, 1932, and 18th September, 1934, are as follows: The acidity as indicated by the pH value* of the soils is as follows:—

——	Treatments.	pH at Depths.	
		0 in. to 9 in.	9 in. to 18 in.
Samples taken 21st July, 1932 ..	Lime ..	5·8	5·72
	No lime ..	5·14	5·68
Samples taken 19th September, 1934	Lime ..	6·1	6·3
	No lime ..	5·4	6·2

* Determined by Mr. B. W. Doak, Analytical Chemist, Plant Research Station, Palmerston North.

The pH values above 5·5 can be taken as indicating slight acidity of the soil, while those below indicate a more acid condition.

Differences in pH values between the two samplings of the same treatment are due probably to natural differences as influenced by the time of sampling and partly to variation in sampling.

Crop-yields.—The following table shows the average production per tree for the various treatments since the commencement of the experiment :—

AVERAGE YIELD PER TREE IN POUNDS OF UNCURED FRUIT AND DIFFERENCES BETWEEN TREATMENTS.

Period.	Dates of Picking.				Average Yield per Tree, in Pounds.		Difference in Favour of Lime (+) or No Lime (−).
					Lime.	No Lime.	
1	10/12/30	16/2/31	12/3/31	..	27·9	30·6	− 2·7
2	24/4/31	28/5/31	11/7/31	14/8/31	61·3	53·2	+ 8·1
3	24/9/31	12/11/31	12/1/32	23/2/32	121·8	109·2	+12·6
4	12/4/32	13/6/32	10/8/32	18/10/32	186·7	164·3	+22·4
5	2/12/32	7/2/33	6/4/33	26/5/33	73·2	66·9	+ 6·3
6	4/7/33	25/8/33	24/10/33	14/12/33	101·9	89·1	+12·8
7	21/2/34	13/4/34	12/6/34	25/7/34	111·7	89·1	+22·6
8	10/9/34	2/11/34	17/12/34	..	84·5	95·2	−10·7

There are no statistically significant (*) differences between yields of limed and unlimed trees when pickings are taken in groups, as above, or in total yields.

The total yield of uncured lemons on a per-acre basis for the four years was : Lime, 83,585 lb. ; no lime, 75,830 lb. ; the total difference in favour of the lime being 7,745 lb. per acre.

Curing.—Commencing with the picking on 24th April, 1931, lemons from each treatment were kept separate during the curing-process, and the following summary shows the weight of cured fruit as percentages of uncured, the grading of fruit, and the numbers of diseased lemons, &c., from each treatment for the period 24th April, 1931, to 2nd November, 1934.

WEIGHT OF CURED FRUIT AS PERCENTAGES OF UNCURED, GRADING, ETC.

Treatment.	Cured Fruit as Percentage of Uncured.†	Percentages of Cured Fruit in Various Grades.‡			Rejects : Average Number Fruit per 100 lb. of Uncured Fruit.§
		First.	Second.	Third and Fourth.	
Lime ..	82·7	35·7	41·7	22·7	30·1
No lime ..	80·8	36·1	42·4	21·5	32·6

* " Statistically significant " means that the chances in favour of the differences being due to manurial treatment and not to chance variation are greater than 30 to 1.

† Includes green, silvered, coloured, and tree ripe.

‡ Includes green, silvered, and coloured.

§ Rejects approximately 93 per cent. blue mould, 2 per cent. brown rot, and 5 per cent. other causes from " limed " trees, and 90 per cent. blue mould, 4 per cent. brown rot, and 6 per cent. other causes from " no lime " trees.

Trunk-circumferences.—The following schedule shows the average circumferences in each treatment, together with increases,—

Treatment.	Average Trunk Circumference (Inches).				Average Increase, in Inches, 1934, over 1931.
	1931.	1932.	1933.	1934.	
Lime (nineteen trees) ..	18·8	19·9	21·8	23·4	4·6
No lime (eighteen trees)	18·7	19·9	21·9	23·3	4·6

At the end of the four-year period during which the experiment has been running there is no apparent difference in the condition of the trees or of the fruit on the limed and unlimed plots. Following the applications of lime it was recorded that the texture and quality of the fruit had been improved, but this improvement was not maintained.

It is desired to acknowledge the assistance received from Messrs. A. W. Hudson (late Crop Experimentalist) and J. W. Woodcock (Crop Experimentalist) in connection with the planning of the experiments and the analysis of statistical data. Thanks are also due to Messrs. L. M. Estcourt and A. R. Grainger, Orchard Instructors, for carrying out the work on the plots, and to Messrs. Mayfield Bros. and the Tauranga Citrus Growers' Association and their staff for assistance willingly rendered. The action of Pacific Potash, Ltd., and of Imperial Chemical Industries, Ltd., in donating fertilizers, and the Department of Scientific and Industrial Research in supplying funds for other fertilizers and railages is very much appreciated.

SOUTHLAND CROP COMPETITIONS.

SUTTON CUP AWARDS, 1934–35 SEASON.

A. STUART, Instructor in Agriculture, Invercargill.

THE competitions, which are under the auspices of the Southland Agricultural and Pastoral Association, are for the best swede crop and for the best turnip crop. The areas of crops eligible for competition are 4 acres of swedes and 5 acres of turnips.

The 1935 competition attracted eighteen entries for swedes and three entries for turnips, in comparison with eleven and one respectively last season. This can be considered satisfactory for the rather unfavourable growing-season experienced. Contrary to the general opinion, this season's average tonnage in swedes is equal to that of last season's entries, being 44 tons per acre.

In the swede competition, Mr. J. Grant, Bayswater, gained first place; second place was secured by Mr. W. Cavanagh, Pukemaori; and third by Mr. G. S. Young, West Plains.

In the turnip competition, Mr. R. H. Dickie, Tuturau, occupied the premier position, the second and third places being filled by Mr. W. Sadlier, Woodlands, and Mr. A. O. Fleming, Mabel, respectively.

Mr. Grant sowed the variety Masterpiece in mid-November at the rate of 14 oz. per acre. Equal parts of superphosphate and bone were applied at the rate of 3 cwt. per acre. The area had been thinned and twice scuffled.

Mr. Cavanagh sowed four varieties mixed (Elephant, Masterpiece, Champion, and Herning) at the rate of 14 oz. per acre, on 15th November. A mixture of equal parts of superphosphate, Seychelles phosphate, and carbonate of lime was applied at the rate of 3 cwt. per acre. This was mixed a week before sowing. The crop was hand-thinned and scuffled.

Mr. Young sowed two varieties, Elephant and Masterpiece, about the 22nd November, at the rate of 16 oz. per acre. Five hundredweight of a mixture consisting of 4 parts Seychelles phosphate, 4 parts bone, 2 parts superphosphate, and 1 part potash salts were applied. The area was hand-thinned and scuffled twice. The swedes were "topped," and accordingly lost at least six points in yield.

Mr. Dickie sowed Aberdeen Green Top at the rate of 16 oz. per acre. The land had been prelimed with 1 ton of burnt lime, and 2 cwt. of a mixture of 2 parts superphosphate, 2 parts lime, 2 parts blood and bone, 2 parts Seychelles phosphate, and 1 part potash salts was pre-top-dressed, and 2 cwt. of the same mixture was sown with the ridger. The area was machine-thinned and scuffled three times.

Mr. Sadlier sowed Waite's Eclipse at the rate of 7 oz. per acre in mid-November. Three hundredweight per acre of reverted superphosphate was applied. The area was hand-thinned and scuffled.

Mr. Fleming sowed a mixture of Green Top and Purple Top Aberdeen at the rate of 8½ oz. per acre. The land was pre-limed with 10 cwt. per acre of burnt lime. At sowing it received 1 cwt. of Ephos and 1 cwt. of Seychelles phosphate, and ½ cwt. of potash salts applied down the front spout. The area was thinned, saddle-harrowed, and scuffled.

The points awarded to the prize-winning crops were :—

Competitor.	District.	Yield in Tons.	Husbandry.	Evenness.	Quality.	Total Points.	Place.
		Swedes.					
Grant, J. ..	Bayswater	65	9	10	19	103	1
Cavanagh, W. ..	Pukemaori	61	8	9	19	97	2
Young, G. S ..	West Plains	55	9	10	19	93	3
		Turnips.					
Dickie, R. H. ..	Tuturau ..	33	9	9	18	69	1
Sadlier, W. ..	Woodlands	28	9	9	18	64	2
Fleming, A. O. ..	Mabel ..	23	9	8	16	56	3

Evidence of the prevalence of aphis and diamond-back moth was noticeable in many crops. Damage by the diamond-back moth is a very unusual feature in Southland, and was due to this season favouring insect development.

Club-root was noticed, but in all cases was seen on the root, not on the bulb; this emphasizes the risk of following up with another cruciferous crop.

Another noticeable feature was the prevalence of the condition known as "mottled-heart," seen on cutting. This condition, known in Canada as "brown-heart," was there remedied to a great extent by applying boron compounds at the rate of a few pounds per acre

with the fertilizer employed. This disease did not appear to be confined to any particular variety, as in the above crops the following varieties were represented: Masterpiece, Elephant, Superlative, Tipperary, Crimson King, Grandmaster, Knockdon, and Suttons' Perfection.

A complaint frequently voiced by farmers met during the work of judging was the great falling-off in recent years in the yield of yellow turnips, and it would appear that this has been an important factor latterly in the falling-off of entries in this particular section of the competition.

CANTERBURY EXPERIENCE WITH SUBTERRANEAN CLOVER.*

H. NEAVE and C. H. HEWLETT, Canterbury (N.Z.) Seed Co., Ltd., Christchurch.

THE information contained in this paper is principally first-hand knowledge gained from personal experience extending over a period of six years from our own "Oakleigh" farm, on which there is an area of approximately 1,000 acres in subterranean clover (*Trifolium subterraneum*). The farm is composed chiefly of sandy loams to light shingly soils, and is situated in the Ellesmere County. The information which follows should be of some value to those farmers who have the type of land essential to the successful and economic growing of this wonderful pasture plant.

The first essentials of a fodder plant, it is said, are palatability, nutritive value, and permanency, combined with a plenteous and vigorous growth. A plant to be of the greatest value must have these attributes to a high degree. When palatability is mentioned, undoubtedly more is really meant than the word implies, and what is inferred is that, in addition to being palatable, it must also be nutritious. Now, when it is definitely stated that subterranean clover has all these attributes and many others which will be mentioned, it will be realized that it is a fodder plant which will fill a very definite place in our economic life, and which will be the means of bringing into profit large areas of land in the Dominion which are at the present time just on the border-line or are being farmed to-day at a loss. Our experience goes to show that all kinds of stock are very partial to this clover; in fact, sheep have been seen leaving an area of young Italian rye-grass and concentrating on subterranean clover. There is, therefore, no doubt as to its palatability, and, it may be added, its nutritive value, as stock thrive on it. With regard to its permanency, it has been under observation during a period of six years, and every area has to-day, without exception, a better stand than at any other period during that term, notwithstanding the fact that the part of Canterbury in which the areas are situated has for the past six years experienced exceptionally dry conditions over lengthy periods. The other essential for a pasture plant, that of a full and vigorous growth, is verified by the fact that although it has been sown in conjunction with white

* Paper presented at the 4th Conference of the New Zealand Grassland Association at Christchurch, August, 1935.

clover and cow-grass, with perennial rye-grass and cocksfoot, it has given a greater bulk of feed than any of the other plants mentioned, has certainly proved more permanent than the first three named, and is the only one which has shown a continuous growth throughout the winter. It has been found at "Oakleigh" that subterranean clover dries off earlier in the summer than the other pasture plants mentioned, but, given reasonable moisture in the autumn, it will throw up a marvellous growth again and will continue to do so throughout the winter. There is also considerable value in the aftermath; the plant, being a very prolific seeder and the seed itself being of an oily nature, stock thrive on this plant in its dry state.

Subterranean clover thrives on land of a sandy nature with a good open subsoil, but it also adapts itself to light shingly soils, and it is in each of these types of land where its true value lies. There must be in this Dominion tens of thousands of acres of land as described, and in Canterbury in particular this type of land predominates, so there is ample scope for the use of this clover. Naturally, the better the land the bigger the crop, but it is on the poorer lands that this pasture plant will prove of greater value than any other clover, and it is this point it is considered advisable to emphasize.

Experience shows that early autumn is the best time in Canterbury for sowing, and February or early March has given the best results. In these months surface-sowing is preferable, but should the sowing be delayed to a later period, it always has been found on the light sandy soils that drilling gives better results, owing chiefly to the fact that frosts do not injure the young plants to the same extent as in the case of surface sowing. The importance of sowing in early autumn is emphasized, as this gives the plants more time to establish their rooting-systems, after which the plant will be in a position to throw up a good vigorous growth in the spring. A light grazing only during the first season is strongly recommended; a heavy grazing is strongly condemned, particularly during the flowering period. The reason for this is obvious, as subterranean clover, being an annual, must have an opportunity of maturing in order to be in a position to perpetuate its kind. In our opinion, most of the failures in the successful growing of this pasture plant may be attributed to injudicious feeding during the first flowering period. Though this clover is an annual, it has certain characteristics which make it superior to an ordinary annual, and in a sense more perpetual than a perennial, for it buries its seed-head in the ground and thus makes every effort practicable to re-establish itself. It has also another method of perpetuating itself, which is accomplished in the following manner. In almost every instance each seed-head contains three seeds, and of these, two germinate the first season and the remaining seed does not germinate till the following year. This is just another way of Nature's coming to the rescue, for if for one reason or another the first two seeds do not reach maturity there is always another one left to keep the flag flying. Now this is brought about by Nature supplying the remaining seed with an unusually hard skin, which apparently protects and controls the germ for a longer period. In the seed trade it is not uncommon to find in some samples of white clover, and in lucerne in particular, a varying quantity of what is termed hard seed; and we offer the suggestion

that possibly this is after all another example of Nature's way, and what we may have regarded as a very serious fault, may, in fact, be a blessing in disguise.

Several different mixtures have been used in sowing down, and one of cocksfoot and subterranean clover has given the most satisfactory results. One cannot lay down any hard and fast rule as to the respective quantities of each, but a mixture of from 10 lb. to 12 lb. of cocksfoot and from 2½ lb. to 3 lb. of subterranean clover sown with 44–46 per cent. superphosphate at the rate of 1 cwt. per acre has been quite satisfactory, and in the course of twelve months with judicious treatment this will form a very dense sward of highly nutritious pasture. It has been found that one application every second year of a dressing of 1 cwt. 44–46 per cent. superphosphate made in the late autumn is very beneficial, not very costly, and the subterranean clover responds very rapidly to this treatment.

In Australia workers are concentrating on the early-maturing varieties, such as Extra Early Dwalganup, the reason being that in the later varieties—*e.g.*, that known as Mount Barker—it is found that owing to the excessive heat prevailing over a large area of the Continent the plant wilts and dies before the seed matures, thereby becoming extinct. With the very early varieties the plant is sufficiently matured before the hot weather sets in. In New Zealand the later varieties such as Mount Barker would, it is thought, be of much more value, as they would give a longer growing period; in the hottest and driest periods in Canterbury the plant has always matured and formed its seed quite satisfactorily. If a series of trials could be carried out with different varieties to ascertain those most suited to New Zealand conditions in different localities the work should be of considerable value. We are sowing a small area with a mixture of the earlier variety with that of the Mount Barker to test the possibility of spreading the grazing of the pastures over a longer period.

A further feature of some moment is the fact that this plant is a wonderful soil-improver, and in localities where subterranean clover has been sown down for a number of years the texture of the soil shows a marked improvement, and from that point alone this plant is doing wonderful service. It is possible that in the course of years the physical condition of these lighter soils may be sufficiently improved by subterranean clover to enable them to carry white and red clovers.

In this paper it is desired to advocate the use of subterranean clover not for the heavier types of soils where white and red clover holds, but for only those lighter types of soils where white and red clover does not hold.

In conclusion, it may be said that until five years ago the whole of that 1,000 acres at "Oakleigh" was down in native grasses and tussock, and had not subterranean clover been available to sow down with the rye-grass and cocksfoot it is considered that the two latter grasses would not have held, but that the land would have reverted to native grasses with their lower carrying-capacity.

Pursuant to the Agricultural and Pastoral Societies Act, 1908, the Putaruru District Society has been incorporated.

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING DAIRY-FACTORY AVERAGES FOR THE YEAR 1934–35.

LISTS of butter and cheese manufacturing companies (co-operative and proprietary) which have obtained for their export produce an average grade of 93 points or over for the past dairy year—1st August, 1934, to 31st July, 1935—are given below.

Butter-factories included in this list number ninety-seven, seventy-eight being situated in the North Island and nineteen in the South Island. No less than thirty-four of these averaged over 94 points, the highest individual average being 94·904.

Fifteen cheese-factories obtained a place in the list. Of this number, nine are located in the North Island and six in the South Island.

Company or Proprietor.	Registered No.	Brand.	Tonnage graded.	Average Grade.
Butter-factories.				
Rangiwahia-Ruahine	750	Quail	182	94·904
Awahuri	664	Red Rose	809	94·807
Golden Bay	146	Sovereign	622	94·771
Levin	910	Lake	1,311	94·716
Kaikoura	302	Kai	167	94·673
Kokatahi	1144	Kokatahi	154	94·632
Wangaehu	1326	Wangaehu	605	94·601
Arahura	1516	Arahura	75	94·585
Shannon	1489	Shannon	1,141	94·580
United	1296	Whariti	170	94·543
Lepperton	49	Lepperton	114	94·538
Taieri and Peninsula	54	Peninsula, &c.	19	94·506
Tikorangi	102	Shield	434	94·467
Uruti Valley	300	Uruti	269	94·466
Midhirst	110	Rugby	1,351	94·448
Inter-Wanganui	6	Inter-Wanganui	186	94·436
Rangitikei	1360	Rangitikei	707	94·392
Collingwood	1254	Golden Hills	207	94·366
Rata	938	Rata	1,090	94·283
Mangorei	345	Mangorei	850	94·277
Rongotea	8	Rongotea	865	94·268
Tamaki	1463	Bell	360	94·267
Tarata	631	Tarata	135	94·225
Maketawa	342	M.D.C.	279	94·212
Masterton	1307	Masterton	653	94·164
Kaitaia	1298	Kaitaia	1,803	94·161
Ruawai	66	Ruawai	1,659	94·154
Omata	82	Omata	501	94·152
Tarurutangi	728	Champion	97	94·136
North Taranaki	723	Flax	827	94·132
Moa Farmers'	341	Inglewood, Heath	1,397	94·063
Bell Block	488	Bell Block	168	94·040
Okau	872	Okau	228	94·040
Stratford Farmers'	68	Stratford	1,121	94·013
Waitara	726	Waitara	512	93·989
Golden Coast	387	Golden Dawn	36	93·979
Northern Wairoa	4	Northern Wairoa	694	93·909
Karamea	1570	Karamea	188	93·891
Wairoa	1345	Wairoa, Clyde	621	93·842
Kairanga	1768	Longburn	556	93·804

Company or Proprietor.	Registered No.	Brand.	Tonnage graded.	Average Grade.
Butter-factories—*continued.*				
Norsewood	600	Norsewood ..	948	93·782
Apiti	414	Apiti	328	93·742
Whakaronga	1709	Whakaronga ..	168	93·739
Westland Cold Storage and Dairy Co.	145	Westland ..	126	93·730
Eketahuna	46	Eketahuna ..	109	93·728
Cheltenham	3	Pakeha	2,425	93·710
Wellington City Corporation Milk Department	202	Rahui	84	93·694
Okoia	413	Okoia	1,125	93·691
Kaikohe	40	Kaikohe	307	93·654
Mauriceville	14	Mauriceville ..	779	93·649
Murchison	1888	Airship	180	93·646
Northern Wairoa ..	1358	Northern Wairoa ..	2,669	93·645
Tolaga	1007	Tolaga Bay ..	217	93·637
New Zealand Farmers' Dairy Union	100	Hinemoa	1,071	93·584
Mokau	274	Mokau	187	93·570
Waitoitoi	20	Waitoitoi	96	93·557
West Coast Farmers' ..	675	Silver-pine ..	34	93·545
Rotokare	248	Westown	26	93·537
Maungaturoto	1407	Otamatea ..	1,031	93·513
Tariki	1818	Tariki	320	93·504
Te Aroha - Thames Valley	344	Overseas	2,108	93·485
Rodney	394	Rodney	580	93·483
Opotiki Dairy Association	337	Opotiki	1,645	93·394
Ngatiporou	395	Nati	639	93·391
Kia Ora	926	Kia Ora	1,454	93·385
Morrinsville	330	Lockerbie, &c. ..	2,898	93·370
Waikato Valley ..	297	Waikato Valley, &c.	4,831	93·351
Katikati	1305	Katikati	705	93·316
Alpine	792	Pine	25	93·316
Kaipara	794	Poplar, Filbert ..	2,168	93·312
Piopio	603	Piopio	562	93·308
Heretaunga	1230	Heretaunga, &c. ..	1,146	93·302
Kuku	905	Ohau	147	93·290
Whangarei	1720	Kauri, Taipuha ..	2,829	93·287
Farmers' Dairy Federation	165	Murihiku	163	93·275
New Zealand	1238	Anchor, Acorn ..	2,037	93·260
Eltham	31	Eltham	834	93·258
Tai Tapu	175	Tai Tapu	754	93·250
Matakana	1375	Matakana ..	244	93·243
Whenuakura	1237	Whenuakura ..	216	93·204
Albertland	298	Port Albert ..	816	93·194
Taihape	1188	Tikapu	594	93·189
Featherston	360	Featherston ..	106	93·170
Tauranga	1478	Tauranga	1,357	93·155
Manakau	815	Manakau	207	93·155
Arawa	1887	Arawa	767	93·134
Golden Coast	991	Golden Coast ..	158	93·130
Raglan	1470	Raglan	454	93·117
Patua	73	Patua	82	93·101
Raetihi	717	Raetihi	301	93·097
Canterbury Central ..	55	Fern-leaf	640	93·077
Waipu	1248	Waipu	560	93·049
Rangitaiki Plains ..	133	Rangitaiki Plains ..	3,643	93·048
Hinuera	329	Hinuera	1,150	93·039
Konini	1203	Konini	473	93·025
Waitaki	1013	Waitaki	138	93·012
Co-operative Dairy Co. of Otago	266	Otakou	405	93·003

Company or Proprietor.	Registered No.	Brand.	Tonnage graded.	Average Grade.
Cheese-factories.				
Omimi	74	Omimi	68	93·587
Kaimata	992	The Oaks	357	93·449
Otamita	17	Otamita	102	93·417
Gorge Road	567	Gorge Road ..	146	93·366
Wellington Farmers' Dairy Association	252	Onward	100	93·362
Newall	86	Newall	372	93·334
Rai Valley	519	Rai Valley ..	250	93·207
Kaitangata	1648	Kaitangata ..	123	93·204
Lepperton	49	Lepperton	255	93·150
Waitohi	483	Waitohi	122	93·086
Lowgarth	629	Lowgarth	552	93·080
Kaponga	1696	Rowan	376	93·074
Jolls	487	Maori Chief ..	382	93·044
Kaiparoro	619	Bruce	187	93·019
Elmdale	1721	Elmdale	231	93·009

The Instructor in Agriculture, Whangarei, reports that a dressing of two tons of lime an acre has given outstanding results on the ironstone (laterite) soils at the Bay of Islands.

"McClean's" Palatable Pampas Grass.

McCLEAN'S PAMPAS GRASS, grown at Waitakaruru Nursery, Hauraki Plains, IS A PROVED SELECTED HIGHLY-PALATABLE STRAIN.

All results are founded on accurate stock-feeding trials.

Do not lose valuable years by growing a useless strain.

Dr. H. E. ANNETT, D.Sc. (Lond.), F.I.C., &c., well-known grasslands expert, in a report dated 1st August, 1935, states—"I have visited Mr. McClean's farm on several occasions. It is probable that while some strains of pampas grass may be valuable as fodder others may be useless. Mr. McClean obviously has an edible strain. There may be others on the market, but their value remains to be tested."

THE JOURNAL OF AGRICULTURE, in an article published in October, 1932, states—"During the past winter Mr. McClean has fed 130 head of grown stock and 70 head of young stock on 2 acres of pampas with a run-off of 48 acres."

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CERTIFICATION OF SEED POTATOES.

CROPS PASSED TUBER INSPECTION DURING AUGUST, 1934.

APPENDED is a list of growers whose crops have been subject to and have passed the tuber inspection in connection with the system of Government certification of seed potatoes conducted by the Department of Agriculture. The list supplements that published in the July and August *Journals*, and refers to those crops passed during August. Further tests will be published in later issues.

In the May *Journal* was published a list of growers who have received provisional certificates. The acreage, percentage of foreign varieties present, and the classification and group number representing the relative merits of lines were given in the list, to which intending purchasers should refer.

AUCKLANDER SHORT TOP.

Mother Seed—

Barnett, R., Dunsandel.
Barr, H. C., Prebbleton-Springston, R.M.D.
Basher, W. F., care of F. E. Larcombe, Springston, R.M.D.
Breitmeyer and McFarlane, Little River (Line B).
Burgess, R. W., care of F. Merrin, Eyreton-Kaiapoi, R.M.D.
Caldwell, G., Courtenay, R.M.D.
Carroll, Mrs. A., Southbridge.
Carroll, J., Southbridge.
Carroll, T. F., Southbridge.
Cross, A. E., "Pine Farm," Bennett's, via Rangiora (Line B).
Foster, T. C., Ladbrook's, R.M.D. (Line A).
Foster, T. C., Ladbrook's, R.M.D. (Line B).
Foster, T. C., Ladbrook's, R.M.D. (Line C).
Gilbert, D. R., East Oxford.
Hegan, J., and Son, Southbrook (Line A).
Heron, F., Rangiora, R.M.D.
Kenyon, F., Mina, North Canterbury (Line A).
King, G. H., West Belt, Rangiora.
Marton, W. E., Kaiapoi, R.M.D. (Line B).
Matson, A. L., Box 3, Christchurch (Line A).
Matson, A. L., Box 3, Christchurch (Line B).
Morgan, D., R.M.D., Cheviot, North Canterbury.
Nairn, G., Lakeside-Leeston, R.M.D. (Line A).
Petrie, J., sen., Swannanoa. R.M.D.
Poulton, A. D., West Eyreton, R.M.D.
Purvis, G., Oxford Road, Rangiora.
Rangiora High School, Rangiora (Line B).
Roper, R. S., Halkett, R.M.D.
Royds, G. E., 12 Burnside Road, Fendalton, Christchurch (Line A).
Schluter Bros., Rangiora.
Thomas, J. W., Gray's Road, Upper Fendalton, Christchurch.

AUCKLANDER SHORT TOP—*continued.*

Commercial Seed—

Adams, K. and R., Sheffield.
Boyle, A. D., Orari.
Burrell, T. F., Levels, South Canterbury.
Haines, C., 108 Waimak Road, Harewood.
Ham, A., Grovetown, Blenheim.
Royds, G. E., 12 Burnside Road, Fendalton, Christchurch (Line B).
Royds, R. S., 12 Burnside Road, Fendalton, Christchurch (Line B).
Seivwright, R. M., "Meadows," Washdyke.
Sharlick, J., Marshlands Road, Ouruhia, Christchurch.
Shillitto, R. S., 135 Armagh Street, Christchurch.

DAKOTA.

Mother Seed—

Allen, A., R.M.D., Leeston.
Barnett, R., Dunsandel.
Boyce, A., Doyleston.
Campion, C. A., Highbank, Methven.
Cherry Bros., Kaiapoi, R.M.D.
Cross, A. E., Pine Farm, Bennett's, via Rangiora.
Cross, H. E., Sandy Knolls (Line B).
Johnston, H. W., Dunsandel.
Johnston, R. H., Dunsandel.
Marshall, D., Killinchy - Leeston, R.M.D.
McCartin, J., Leeston.
Nicklaus, J. F., 104 Ryan's Road, Upper Riccarton, Christchurch.
Petrie, J., sen., Swannanoa, R.M.D.
Phillips, A. G., Weedon's, R.M.D.
Robinson, R. P., Waikuku.
Rolston, G., Weedon's - Greendale, R.M.D.
Royds, R. S., 12 Burnside Road, Fendalton, Christchurch (Line A).
Wolff, R. G., Horrelville, R.M.D.
Wright, Q. A., Annat.

Commercial Seed—

Ballantyne, C. T., Gleniti, Timaru.
Burrowes, J., Chertsey, Mid-Canterbury (Line B).
Smart, L. E., Box 3, Lincoln.
Thomas, D., Springston.

ARRAN CHIEF.

Mother Seed—
Anderson, A., Stirling.
Court, R. T., Swannanoa, R.M.D.
Dobbie, R., Menzies' Ferry.
Wright, Q. A., Annat.

Commercial Seed—
Barnes, W., and Son, 199 Highstead Road, Styx.
Henderson Bros., Otapiri, R.M.D., Winton.
Leech, C., Rangiora.
Manson, D., Enfield, Oamaru (Line B).
Morrison, J. L., Morven.

ARRAN BANNER.

Mother Seed—
Amyes, H. G., " Riversleigh," Annat.

Commercial Seed—
Robinson, R. P., Waikuku.
Roper, P. F., Halkett, R.M.D.

KING EDWARD.

Mother Seed—
Anderson, A., Stirling (Line A).
Anderson, A., Stirling (Line B).

AUCKLANDER TALL TOP.

Mother Seed—
Frost, C. H., Balcairn P.O.
Thomas, S., West Belt, Rangiora.

Commercial Seed—
Roper, R. S., Halkett, R.M.D.

MAJESTIC.

Mother Seed—
Cross, H. E., Sandy Knolls.

AMERICAN WONDER.

Mother Seed—
Wright, L. T., Annat.

ARRAN CONSUL.

Mother Seed—
Piner, E., Annat, R.M.D.

BRESEE'S PROLIFIC.

Mother Seed—
Marshall, D., Killinchy, Leeston, R.M.D.

INVERNESS FAVOURITE.

Mother Seed—
Piner, E., Annat, R.M.D.

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THE FARM.

Feeding Efficiency and Special Crops.

In general, the valuable role of special crops to supplement the pastures on arable land in districts of relatively light rainfall is well recognized, even though this fact at times is not reflected adequately in practice. But opinions about the role of special crops to supplement pastures in districts of good rainfall, say, 30 in. or more annually, have not been stable. In such districts a few years ago the farmer who could say he had not a single acre under the plough was looked upon by many as having attained a high standard of efficiency in grass farming, but more recently the trend of opinion among farmers has favoured an increased acreage of forage crops to supplement pastures during the periods of their scant growth. That this trend in the views of farmers is well founded in respect to dairying generally may be seen readily from a consideration of the relationship between the feeding and the production of dairy stock. A study of the data available from herd-testing and factory returns reveals that in the ten months of greatest yield the production of a herd fed at the average standard of efficiency is six to seven times that of the December production, whereas the corresponding production of a well-fed herd of reasonably good producing-capacity is eight to nine times that of the December production. The greatest differences in the results from the two standards of feeding occur in the early part of the lactation period, and from this it is clear that the feeding during the winter-early-spring period particularly is at fault. To cite an illustration, in the case of a herd of high production, for every 100 lb. of butterfat produced in December, 397 lb. of butterfat were produced prior to December; whereas in the case of average herds, for every 100 lb. of fat produced in December, 286 lb. were produced prior to December—a substantial difference of 111 lb. of butterfat a cow for the four months August to November. It is to be noted that this difference arises during a period when the inherent persistency in production of the animals normally does not affect the yields. As a rule, a substantial difference arises also in the latter part of the lactation period. In some instances this difference is due in part at least to differences in the inherent persistency in production, but generally it is due to differences in the degree of efficiency in feeding: the circumstantial evidence provided by "good" late summer and autumn conditions when the universal supply of feed naturally available is particularly good strongly supports this contention, because during such periods of natural abundance of feed the production of herds customarily of low yield often approximates that of reputedly superior herds.

The facts just outlined point to the practical conclusion that, without altering the quality or size of the existing herds, dairy production could be increased by 25 per cent. or more simply by increased efficiency in feeding.

Basic Weakness in Pastures as Sole Direct Source of Feed.

The position as described arises from a basic weakness in pastures as a sole direct source of feed throughout the year. This weakness becomes strikingly apparent when the seasonal feed-requirements of a typical well-fed herd of good annual production are compared with the seasonal production of feed by grassland in districts of good rainfall. The following enlightening comparisons relate to a herd of seventy-eight cows of an average

yield of 391 lb. of butterfat and to the weighed production of well-managed grassland at Marton Experimental Area over a period of three complete years :—

(*a*) During June to September inclusive 292 lb. of feed were required for each 100 lb. required in December, whereas 123 lb. of feed were produced for each 100 lb. produced in December.

(*b*) During February to May 326 lb. of feed were required for each 100 lb. required in December, whereas 75 lb. of feed were produced for each 100 lb. produced in December.

Taking the whole year, the position was found to be as follows :—

(*a*) Under utilization of pastures designed to spread the supply of feed as evenly as possible, from 68 per cent. to 77·5 per cent. of the year's production of feed took place in October to January inclusive and from 22·5 per cent. to 32 per cent. in the remainder of the year.

(*b*) An efficiently fed herd of good production required 39·5 per cent. of the total year's feed-supply in the period October to January and 60·5 per cent. during the remainder of the year.

In short, the seasonal supply of feed was broadly the reverse of the seasonal requirements of feed.

The Position in Sheep-farming.

Much of what has been said up to this stage has referred to dairying. Dairying certainly presents the stronger case for special arable cropping: this is because dairying is faced not only with a critical winter-early-spring period as is sheep-farming, but also with a critical later-summer period during which the sheep-farmer obtains much relief by the disposal of, say, fat lambs.

But the ultimate success of much sheep-farming, as of dairying, is founded upon the milk-supply, and, this being so, the feed requirements in sheep raising parallel, in essential features, those of dairying. The control of parasites of sheep enters as an additional factor of considerable moment. Hence in practice a close association between special arable cropping and uniform marked success in sheep-raising is often to be found.

How Top-dressing influences the Seasonal Feed-supply.

It may be thought that a more even supply of feed throughout the year would result from judicious top-dressing, but data obtained from investigational work shows that, apart from special nitrogenous top-dressing, top-dressing actually broadens appreciably the absolute gap between winter production on the one hand and late-spring or early-summer production on the other hand: in one typical case the gap in the daily production per acre between October production and May to August production was 111 lb. when no manure was applied, whereas it was 168 lb. when 3 cwt. of superphosphate an acre was applied in the autumn.

Remedying the Position.

There are two main schools of thought relative to the method of remedying the position.

One advocates dependence mainly on ensilage and hay-making and frequently suggests also the exploitation of such auxiliary practices as nitrogenous top-dressing and the use of special pastures to give feed when pastures normally fail—*e.g.*, special paspalum or cocksfoot and red-clover paddocks for summer and special subterranean-clover paddocks for winter and early spring. Though definite knowledge about the general utility and economic standing of these auxiliaries seems to be scant, it may be granted that they could be employed at times with advantage, and this more frequently than they have been employed in the past.

Relative to the role of ensilage the following statements are submitted as a summary of the position :—

(1) In districts of good rainfall on the majority of the dairy-farms devoted dominantly to pasture ensilage should be practised, and it could also be introduced advantageously into the work of a much greater number of sheep-farms than now practise it.

(2) Widely and often the mid-January to mid-March period is a critical one for which silage of the sort commonly made is far from ideal as a supplement to pastures in the rations of dairy cows.

Further, it is extremely doubtful whether there is any justification for an attempt to induce farmers generally to produce a different type of silage—one made from much more leafy and immature herbage would be needed to meet the late-summer feed requirements in dairying.

That supplies of silage of the type generally available have distinct limitations as a summer feed for dairy cows was rather freely illustrated during the 1935 summer, when, because of the dry season, greater use than usual was made of it.

(3) The most inexpensive way of harvesting the pasture crop is that which dispenses with special labour and equipment—*e.g.*, grazing.

(4) The least wasteful way of harvesting the grass crop is grazing : account has to be taken of the wastage due to fermentation, leaching, &c., in both ensilage and hay-making.

(5) Grazing ordinarily is more compatible with the continued welfare and possible improvement of the swards on an economic basis.

(6) Even if silage were entirely suitable as a supplementary feed, it would not be at all easy to build up reserves of it adequate to give a full measure of safety in the event of successive unfavourable seasons.

The second school of thought allots to special crops, such as mangels, lucerne, chou moellier, an important place on many farms in districts of good rainfall, in the task of suitably levelling out the supply of feed from season to season. At the same time, normally an important place in the task is also given in ensilage and hay.

Properly planned special cropping provides a supply of feed both adequate in quantity and suitable in quality throughout the year. There is no conclusive evidence that generally this result can be obtained satisfactorily in any other way over a series of years.

Judicious special cropping provides an opportunity for the replacement of inferior pastures. Often the fact that special cropping necessitates the breaking-up of pastures is advanced as an objection to such cropping, even in relation to farms on which more breaking-up of pastures than is taking place is definitely advisable if the most economic production, irrespective of the influence of cropping, is to be obtained from the pastures. This position has been intensified by recent advances in strains of pasture plants. Even in districts in which grass farming is at the highest pitch of efficiency, farms on which no pastures could be resown with advantage are extremely rare. Hence any setting of the cost of replacing pastures as an item against special cropping is largely the creating of a bogy. In this connection it seems highly significant that in one of the best grassland districts in the Dominion the farms which have the greatest amount of really good pastures stand out in respect to the amount of arable cropping carried out on them.

When a search is made for the explanation of the association of good pastures with cropping the line of thought necessarily travels in a circle : the better the pastures the more the need for special cropping to balance the seasonal supply of feed ; the more special cropping the more opportunity of basic improvement of pastures.

Suitable supplementary cropping is the necessary basis of the most effective and profitable development of the increasingly important side-line, pig-meat production. This position will be intensified with any change-over from the production of porkers to that of baconers. Often simple extension of the area required for dairying in respect to such crops as mangels, chou moellier, swedes, carrots, and lucerne would assist the pig-feed position greatly. The growing for pigs of additional crops such as barley and peas is often well justified.

Special cropping also reacts favourably in the important task of breeding replacement stock.

It is advanced against cropping that it involves additional outlay in equipment and horses and the keep of working horses. Probably this is of less moment than is sometimes thought. In the 550 North Island dairy-farms reviewed in the report of the Dairy Industry Commission there were 2·61 working horses per farm. Incidentally there were more horses per farm and fewer acres of farm per horse in the districts in which least arable cropping was done. In the different subdivisions of the Auckland Land District there was one horse to each 38 to 43 acres; in Taranaki there was one horse to each 50 acres; over all the farms there was one horse to each 47½ acres. Against this position is to be set the fact that in the Auckland Land District 1 acre of arable crop was grown to every eleven dairy cows, whereas in Taranaki there was 1 acre of arable crop to every nine cows.

The average capital value of the implements per farm is enlightening. It did not differ materially from district to district. It amounted to £157 per farm. This value seems sufficient to meet most of the needs of the relatively modest arable cropping programme desirable for herds of from fifty to seventy cows. It would seem then, that in respect to horses and implements, arable cropping generally presents no substantial difficulties.

The foregoing considerations either singly or together do not form a complete case either for or against the advisability of supplementary cropping. In fact, some of the decisive considerations have not been mentioned.

Labour-supply an Important Consideration.

One of these is labour. The position summed up is: If supplementary cropping can be done by the labour already employed regularly on a farm without bringing about neglect of some other essential farm task, then it will prove profitable to do the supplementary cropping. But as the amount spent directly on hired labour for cropping increases, the profit from the cropping tends to decrease until a point may be reached when a greater net profit would be obtained by dispensing with the cropping even though the cropping itself is profitable. As an instance, one may cite two similar farms of 60 acres. One was wholly in grass. On the other production was driven up by from 35 lb. to 40 lb. of fat an acre by cropping. The returns from the additional butterfat largely were eaten up in costs of cropping, which necessitated the employment of an additional adult farm hand. But such cases are not general. Further, and this is of great practical importance, they can be obviated usually if the additional labour is utilized fully and judiciously. In the case cited, if the pig-production potentialities of the place were exploited to the further extent that the additional labour allowed, the additional pig returns would have recouped much of the additional labour outlay and thereby set the position right.

On the farm wholly in grass one man with a small amount of help from his family handled about 40 cows, and cropping would have necessitated an additional adult. While such a farm is of importance as an illustration of the important bearing of labour considerations, it seems well to emphasize that it is not illustrative of the general position. This may be gleaned from

the fact that the number of cows generally handled per labour unit is approximately twenty-one (Report Dairy Industry Commission). With such a labour-herd relation time for cropping normally is available.

Bearing of Weather, Weeds, &c.

A second factor which determines the advisability of supplementary cropping embraces soil and weather conditions upon which reliable and economic yields depend. One illustration of this is the sandy Wellington–West Coast belt. One cannot but approve of the practice of some farmers of this belt who employ lucerne for summer and subterranean clover for winter as substitutes for arable cropping, and this with considerable success. Another important illustration is provided in parts of North Auckland, where there is a combination of heavy soils and abundant rainfall which militate against constant success with arable crops.

A third important factor determining the advisability of arable cropping is the weed position—*e.g.*, Californian thistle may so militate against successful results being associated with arable cropping as to be the deciding factor.

The Potato Crop.

In many districts the main crop of potatoes should be sown in October. The use of unhealthy seed is probably more productive of unsatisfactory yields than the joint effect of all other factors which bring about decreased production. The most serious type of disease is " virus " disease, which is borne in the tubers in which it cannot be detected by the eye, although it can be detected readily in the foliage. Hence it is impossible to tell by inspection of " seed " whether or not it is reasonably free from virus, and because of this the only safe course is to use certified seed—*i.e.*, seed which has been passed under the official system of certification. The cutting of seed potatoes at times leads to many blank spaces in the rows of the resultant crop due to the rotting of the cut portions. Rotting is greatly lessened if the conditions are suitable for the healing of the cut surfaces. Dry conditions in particular do not favour healing. Hence, while it is good practice to cut and plant immediately into a moist soil, it is not good practice to leave cut potatoes in sunlight or to plant them at once into dry soil. Special care needs to be taken in regard to Aucklander Short Top, Aucklander Tall Top, Majestic, and King Edward, which do not heal readily after cutting. If cut potatoes are to be kept for a day or two they should be stored in a moist place or covered with wet sacks.

General Work.

It is inadvisable to omit treating cereal seed suitably for the prevention of smut. Unless seed-treatment is carried out properly, it is very likely either to cause serious injury to the seed or to be ineffective as a means of controlling disease.

September is often a suitable month in which to close up areas of lucerne. Early closing tends to result in an extra cut being obtained annually, and also in minimizing the damage caused by invading plants which outgrow lucerne early in the season.

It is often worth while to sow in October an area of quickly maturing soft turnips, such as Purple-top or Mammoth, for use early in the New Year: while the yield from such an area may not be heavy, it is likely to be valuable in avoiding an unduly rapid and early falling-off in butterfat-production commencing at about the New Year.

Kales, including chou moellier, have been sown with good results in October: such sowings have provided feed in February. Later sowings may well be made for use in the autumn and winter.

R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Pest and Disease Control.

BEFORE these notes appear a commencement will have been made on the seasonal spraying programme, and this major work will now be receiving the close attention of all growers. The base spray of Bordeaux (5–4–50) should already have been applied, as also should the winter-oil spray for the control of scales, red mite, &c. Thoroughness of application should not be lost sight of by growers, and strict attention to this matter will save considerable expense and avoid disappointment during the season.

The base spray having been applied, attention should be given to the cover sprays. A point to bear in mind is that "prevention is better than cure." The aim should be to obtain complete and continuous coverage during the period disease is active. It should be remembered that at this period of the year there is a rapid increase of leaf surface, together with shoot-extension and development of buds and fruit, and that failure to maintain efficient coverage may be the means of disease getting out of control and may involve the orchardist in considerable expense to bring it again under control.

It is not advisable, irrespective of weather conditions, to follow the practice of spraying at fixed "stages." In the early part of the season when growth is active and when, because of the weather conditions infection from fungous diseases is on the increase, the grower should arrange his spray applications so that the intervals between sprays are not of such length that new growth is left unprotected for any great length of time or beyond the period of efficacy of the previous spray. A point to note is that the effective period of coverage of lime-sulphur and other sprays following application at this period of the year under favourable conditions is approximately ten days. Weather conditions should also be taken into account, and the frequency of applications must be determined by the grower with the foregoing points in mind.

Stone-fruit trees should now be receiving protective sprays against brown rot, shot-hole, peach-scab, &c., and lime-sulphur at 0·083 per cent. plus colloidal sulphur 2 lb. to 100 gallons is recommended. This should be applied at petal-fall, and if blossom infection of brown rot has occurred, or if unfavourable weather is experienced, should be repeated after an interval of ten days, otherwise in three weeks.

For pears Bordeaux (3–4–50) is recommended, with the addition of arsenate of lead 1½ lb. to 100 gallons of spray following petal-fall, excepting on tender, clear-skinned varieties, when lime-sulphur, 0·1 per cent., should be substituted for the Bordeaux.

For the present month, on apples lime-sulphur 0·2 per cent. may be used up to the blossom period, to be followed by lime-sulphur 0·1 per cent. plus colloidal sulphur 2 lb. and arsenate of lead 1½ lb. to each 100 gallons in combination at petal-fall, and repeated in from ten to fourteen days. Where powdery mildew is very prevalent an application of lime-sulphur should be made at the "pink" period. It is also advisable to increase the amount of colloidal sulphur from 2 lb. to 3 lb. in the combination spray.

In preparing the combination spray of lime-sulphur, colloidal sulphur, and lead arsenate, the addition of 3 lb. of hydrated lime per 100 gallons of spray retards the chemical reaction between the lime-sulphur and arsenate of lead, usually characterized by the spray mixture turning black. In preparing this spray the lime-sulphur should be added to the tank as it is being filled with water, followed by the colloidal sulphur, and then the hydrated lime and arsenate of lead creamed together and added finally with the agitator running.

A watch should be kept for the first appearance of the nymphs of the apple-leaf hopper, and nicotine sulphate 40 per cent. at 0·05 per cent. (1–800) should be added to the combination sprays for control. This will also assist in keeping in check the red mite. Nicotine sulphate at same strength should also be used at the first appearance of aphides. When this specific is to be used alone, the addition of soft soap 4 lb. to each 100 gallons of spray is recommended, otherwise it is largely non-effective. The soft soap should be dissolved in 4 gallons of warm water to which is then added the requisite amount of nicotine sulphate. This should stand for twenty minutes before being added to the spray tank of water.

The russeting of fruit was a serious problem to growers and especially so to exporters last season. It appears that pip-fruits are most subject to russet between the advanced " pink " stage to the " calyx " stage. The trouble seems to be induced largely by seasonal conditions. A cold wet spring, particularly if the unfavourable conditions coincide with the period between advanced " pink " and " calyx," appears to cause russet, the trouble being further accentuated by sprays applied during this period of fruit-development. With warm favourable conditions during this period russeting is usually almost non-existent. Where Bordeaux sprays have been applied late in the season there is a possibility of their coming in contact with the young fruits and causing russet, and it is therefore wise to apply them sufficiently early to avoid this.

Cultivation.

Where spring ploughings are being made they should be completed as early as practicable and the summer cultivation commenced. The early aeration of the soil greatly assists the early and active increase of the beneficial soil bacteria, which play such an important part in soil fertility. Furthermore, the maintaining of a good soil tilth assists in the retention of soil moisture during dry periods, and largely minimizes the ill effects, both to the tree and to the fruit crop, of drought conditions. The ground should not be allowed to harden and crack, but should be stirred as soon as practicable following rain.

Manuring.

The application of phosphatic and potassic manures should not be further delayed. The first application of a nitrogenous fertilizer should now be made, followed by a further application two months later. It generally is accepted that the application of manures should be at the rate of 1 lb. of a balanced manure to each case of fruit produced per tree. The nitrogenous content should be increased for debilitated trees and decreased for over-vigorous trees.

—R. G. Hamilton, Orchard Instructor, Hamilton.

Citrus Notes.

Owing to the continued wet weather every opportunity should be taken to keep the soil surface directly under the trees well stirred to give sufficient aeration to prevent the development of brown rot. In addition to this, all branches which are inclined to brush the soil should be removed. An application of Bordeaux mixture (3–4 50) to coincide with the blossom-fall of the main crop acts as a protective spray against brown rot and verrucosis. Adequate drainage is also very essential to the health of citrus trees, especially during such a wet season as is at present being experienced. Growers should also be prepared for the possibility of a late frost, which is likely to follow when the weather takes up, and those growers who have equipped their groves with fire-pots should see that everything is in readiness.

Manuring.—The application of nitrogen to the trees should be delayed until the period of frost danger is past, but a dressing of sulphate of potash may assist in increasing the resistance of young growth to injury.

In the case of newly established plantings, every chance should be given the trees to develop; all shoots not required to form the frame of the tree should be rubbed off, and any strong perpendicular shoots should be cut out to encourage side growth. Any planting still to be done should be completed as soon as possible, so that the trees can become established before the hot weather commences.

Spraying.—As soon as the trees are in active growth there is little danger of damage to the foliage by the use of a summer-oil spray for the control of scales and other sucking insects. As soon as the young growth has hardened an oil emulsion can be applied. Summer oils at a strength of 1–33 for red scale and 1–80 for other sucking insects are now generally preferred, as there is less danger of damage to foliage than when the winter (red) spraying oil is used, and they give a much more effective control. If thrips are in evidence spraying with nicotine sulphate (1–800) is necessary; this may be combined with the spring spray of Bordeaux (3–4–50) applied for the control of verrucosis and grey scab.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Time of Hatching.

UNTIL recently, September was considered rather early to hatch chickens of the light breeds, but now-a-days most of the larger poultry-farmers aim to have their last hatch out before the end of this month.

Where the natural method of incubation is depended upon, it is not always possible to get broody hens when required, and quite a few poultry-keepers, who rear only a few pullets each year, wait until certain hens known to be good setters become broody. As a rule such hens as they get older take longer to come on to lay, with the result that each year they are later going broody. In such cases, where Leghorns comprise the main flock, and only a few of a heavy variety are kept for setting purposes, it is a good plan to rear a few heavy-breed pullets each year to take the place of the older broody hens.

Experience has shown that September is the best month in which to hatch out the light breeds, and therefore every effort should be made to secure the number of chickens required before it is too late.

On many plants which have been visited beginners, being anxious to build up their flock to a certain number of pullets, during the first year have hatched later than their more experienced neighbour would. The result has invariably been that the late-hatched pullets, instead of being an asset, have proved a liability, having eventually to be culled out and sold at a loss. It is a much wiser plan to take as an example the successful man who has proved his knowledge, and who will not hatch after a certain date even if he has not obtained the number of pullets he would like. The average production of one's flock is what counts, and it is much wiser to aim for a medium-sized flock of good birds than a larger number amongst which are many inferior specimens: quality and not quantity should be the policy.

If late-hatched chickens have to be reared, extra care should be taken to see that such stock are raised on fresh, sweet ground away from where adult birds have been running. Brooder chickens will require careful watching from now on, and special care should be taken to guard against over-crowding. A canopy brooder in the early part of the season, and when the chickens are first hatched, may accommodate from 300 to 400, but when such chickens are three weeks old less than half that number is quite sufficient under the same hover. Cleanliness is essential at all times, but after brooder chickens are three weeks old, it is a

good plan to place some fresh litter under the hover each night. If the chickens are watched closely just as they are camping for the night to see that they do not crowd in heaps, and plenty of clean dry bedding material is provided, much trouble and loss may be avoided. As the chickens grow, it is well to see that more ventilation is provided at night, and in fact once they have settled down for the night very little artificial heat is required after the chickens are three weeks old. It is not to be inferred, however, that no artificial heat is needed, but if poultry-keepers who notice their chickens going off after they are about three weeks old would take the temperature under the hover, or in the brooder after the chickens have camped for the night, they might find the reason for the chickens not doing so well.

Feeding Chickens.

Many different and successful methods of feeding chickens are in use, and most poultry-keepers have their own systems. The following has given good results: The first feed when the chickens are about thirty-six hours old may consist of a good grain mixture (chick size), finely broken wheat, or three-parts finely broken wheat and one part of finely broken maize. It is a good plan to pour some whole milk on the quantity required about an hour before feeding-time in order to soften the grains, and any of these may be given four times a day for the first two feeding-days. A little finely ground oyster-shell should also be given. From two days until about nine weeks old, four feeds a day may be given, the first and last feeds being a grain mixture made up of three parts cracked wheat, one part shelled oats, and one part cracked maize, and the size of the grain may be increased as the birds grow. The other two feeds may consist of a mash made up of three parts pollard, two parts bran, one part finely cut succulent green feed, and 5 per cent. of bone-meal, the lot to be mixed with skim-milk, but if no skim-milk is to be had it is well to add about 7 per cent. of butter-milk powder or from 3 per cent. to 5 per cent. of meat-meal.

Green feed is a very important item, and in addition to that given in the mash a supply should be given each day after the chickens are three days old, but care should be taken to see that whatever is fed is succulent and tender.

Milk is one of the best feeds for chickens, and, if possible, should be given from the second day. After the first week sour skim-milk will be quite suitable as a drink, but it is not advisable to give it sour one day and fresh the next. Allow the chickens plenty of space at feeding-times, as crowding at feeding-times often starts toe-pecking. Many large poultry-keepers feed their mashes on sacks.

Hatching Duck Eggs.

Duck eggs generally lose vitality and fertility sooner than hen eggs, and therefore they should be set as fresh as possible and not older than seven or eight days. They require a slightly lower temperature within the machine than hen eggs, especially during the first ten days, and a temperature of 102° during that period, 103° from that on, and 103½° to 104° (not higher) whilst the ducklings are hatching should give good results. Duck eggs require a little less ventilation than hen eggs to start with, but when the eggs start to chip, which is usually about the twenty-fifth day, they require more ventilation than is generally given when hatching hen eggs.

During the last ten days it is advisable to spray duck eggs with warm water (about 103°), and this may be done with the mouth or a small brush, once each day. Do not cool after spraying, but spray in the morning and put the eggs straight back into the machine and cool at night.

Export of Eggs.

During last season some 11,527 cases (345,600 dozen) of eggs were shipped to the United Kingdom, and exporters hope to increase that number by

about 25 per cent. during the current season. Though the prospects of building up a large profitable egg-export trade are not very encouraging at the present time, all poultry-keepers realize how essential it is to unload the spring surplus on the overseas markets in order to maintain local values. There are some producers who have not done their share regarding export, and this is a matter that has caused and still is causing a good deal of dissatisfaction amongst those who have always supported export in a practical way, and have at times received less than those who have sold all their eggs on the local market during the export season. In their own interests producers should see that eggs are sent to market in the best possible condition.

The three most desirable qualities in a good marketable egg are freshness, cleanliness, and flavour. Eggs should be marketed at least once a week, and if possible more often, especially during the hot weather, as they deteriorate quickly if exposed to warm temperatures, and their food value is soon destroyed, especially if fertile. When fertile eggs are exposed to a certain temperature, whether it be in a hot kitchen, under a hen, or on a railway-platform the embryo starts to develop, with the result that the flavour is soon spoiled.

During the grading and packing of eggs for export during the past ten years, more eggs have had to be rejected on account of the shells being more or less soiled than for any other cause. If eggs were collected twice a day during wet weather and plenty of clean nesting material provided for the birds much of this trouble would be avoided. When eggs are so soiled that they need washing it is a good plan to wash them in warm water as soon as they have been collected and before the animal heat leaves the eggs, as they are much less trouble to clean than when left till after they get thoroughly cold.

A large number of eggs were rejected on account of being slightly cracked. Perhaps a little more care exercised when collecting and packing for market would help to reduce this loss. A fair number had to be rejected on account of being a bad shape or too small. This fault is really a matter of breeding, and if only those eggs of a good size, shape, and texture of shell were used for hatching purposes a good deal of this trouble would be corrected.

Eggs having tremulous air-cells and watery whites have to be rejected. Much investigational work has been carried out by this Department and in other countries in an endeavour to ascertain the cause or causes of this defect. The result of tests carried out points to the fact that the method of packing for transport has considerable influence on the internal condition of many eggs, and if they are packed with the large end down tremulous air-cells and watery whites are likely to be produced. Also if eggs are allowed to get into a sweated condition the same defect is likely to result.

If all poultry-keepers would see that eggs are gathered regularly, marketed clean, at least once a week, in clean dry fillers and cases, and packed with the large end up, not only would the local market (which is the poultry-keepers' best market) be improved, but a larger percentage of eggs sent to the export floors would be shipped overseas.

—C. J. C. Cussen, Chief Poultry Instructor, Wellington.

THE APIARY.

Attention to Feeding where necessary.

As advised last month, advantage should be taken of the milder weather conditions obtaining to complete the spring overhaul. This work should not be delayed, as broken weather which may be experienced not only delays operations but prevents the bees from gathering sufficient nectar to meet the requirements of the colony with its increasing number of young bees and larvæ to feed. The first examination is of the utmost importance, as it may reveal either cases where the stores are insufficient for the immediate requirements of the colony or cases of queenlessness.

The spring months are most critical for the bees, and the beekeeper will find that if adequate stores are not provided his losses from starvation will be as great as if not greater than those which result from inattention to disease. Few but experienced beekeepers, and those who suffer financially, realize how readily the supply of stores may become exhausted after breeding is in full swing in spring. Usually willows and other spring forage afford a good supply of nectar, but too often these sources of supply are cut off owing to the unsettled weather which invariably obtains in the spring. Normally where colonies contain good queens breeding will go ahead rapidly ; as the colonies comprise a larger number of bees and larvæ the drain on the stores is enormous, and if left without food during a week's bad weather the colony will perish.

Reference to feeding at this period would not be necessary if careful consideration had been given to the matter at the proper time when placing the hives in winter quarters. It is in the autumn that the foundation of the next season's crop is laid, and this point is too often overlooked. Feeding to obviate starvation may be necessary, but it should be considered only as an emergency measure, and not one of general apiary practice. Too often beekeepers when taking the surplus pay little or no attention to the future requirements of the colonies in the way of stores, and in the process ultimately lose many that would otherwise yield a surplus.

Should feeding be necessary, a syrup comprised of one-third sugar and two-thirds water may be used. Use only the best white sugar. Once feeding is started it should be continued until such time as the bees can gather sufficient from natural sources.

Swarming.

In the warmer parts of the Dominion, and where colonies are up to normal strength, swarms may be expected any time in October. Many beekeepers attribute swarming to overcrowded brood chambers, lack of ventilation, and poor queens ; but it often happens that swarms issue when none of these conditions is present. On the other hand, bees will refuse to swarm when everything is apparently conducive to their doing so. It must be left to the beekeeper to decide whether he will increase his stock by natural swarming or artificially. If the former plan is adopted it will be wise to allow only strong colonies to swarm. If a weak hive is showing symptoms of swarming, that is, if the bees are building numbers of queen-cells, these should be removed and the colony prevented from swarming until such time as it can be requeened. A swarm from a weak hive is not worth encouraging, because it consists simply of a poor queen, probably failing, and a small cluster of bees.

If, however, a strong colony has made up its mind to swarm, the best thing to do is to allow it to throw a prime swarm, and then to guard most rigorously against after-swarming. This can best be done by cutting out all the queen-cells save one after the prime swarm has issued. Even then it is wise to watch carefully the parent hive for about ten days after the departure of the prime swarm, because there will be eggs in the old hive, and the bees may continue to raise queen-cells.

Prevention of Swarming.

Frequent examinations of the colonies—every week or ten days during the swarming season—for the purpose of cutting out queen-cells is a help ; but this requires considerable work, and, since it frequently fails in spite of every care, it is not usually relied on.

The occurrence of swarming is largely due to overcrowded brood-chambers ; hence the queen should be given plenty of room to lay. A suitable plan is to give a new brood-chamber comprising two drawn combs and the rest frames of foundation. It is advisable to secure the queen and confine her in this new chamber below a queen-excluder, placing the old brood-nests directly above, thus giving additional work for the young bees

and plenty of room in which the queen may lay. If for some reason this plan is not desirable, the brood may be equalized by robbing the stronger colonies for the benefit of the weaker.

A young queen in the hive is an outstanding factor of success, as bees are rarely inclined to swarm with a young queen if they have reared her themselves under natural conditions. This feature, however, is not always satisfactory to the beekeeper, as he frequently buys young queens in large numbers from a queen-breeder. He still has to contend against the swarming impulse, although in a lesser degree. A beekeeper rearing his own stock should select not only prolific queens from which to produce, but those that previously have shown the least tendency to swarm. There are also other reasons why young queens should be employed, and the practice of introducing them in the spring before the swarming-season commences, at intervals of not longer than two years, is an excellent one. Autumn introduction is also commendable, as the full tide of a queen's maturity is gained from the commencement of the following spring. In order to follow the lives of the mothers as closely as possible and to avoid mistakes some system of recording the various ages must be employed. In addition, notes should be taken of their general behaviour, such as tendency to swarm prolificness, and gentleness. Such notes will prove of great value in selecting a mother of future queens.

Ventilation also plays an important part in controlling the natural inclination to swarm, and care should be taken to provide sufficient air at all times of the season. A well-known and effective method is to place blocks 1 in. high under the two front corners of the brood-chamber. In the very flush of the honey-flow additional ventilation may be given by drawing one of the supers forward over the rest. This forms two additional entrances and permits the workers to escape to the field without having to traverse the whole depth of the hive.

No single system will be found universally effective. Climatic conditions also frequently play an important part in the behaviour of bees. It will be found, however, that the methods here given, or variations of them, employed either singly or in combination materially assist in the prevention of swarming.

Prevention of After-swarming.

In many cases a prime or first swarm is desirable, and in others the bees often issue in spite of all precautions. It is a simple matter to hive the swarm, but to combat the results in the parent colony arising from this condition entails special action. Persistent after-swarming is one of the discouraging features of natural increase, and is often hard to stop. A good plan is to place the swarm on the old location, removing the parent colony to a new stand some distance away. The immediate result is for all the flying bees to join the swarm, and thus the parent colony is still further weakened. This encourages them to tear down all queen-cells but one, or to destroy all embryo queens after the first young queen has emerged from her cell.

Treatment of Swarms : Providing Supers.

There is little doubt in the minds of many beekeepers who have been accustomed to box hives as to the surplus to be obtained from a swarm. It is not uncommon to find swarms put into frame hives and not provided with room for surplus. Unless supers are given to strong early swarms from ten to fifteen days after they are established, these colonies will often swarm again and no surplus will be obtained. It must be understood that the season plays an important part in the returns netted, but large amounts are lost yearly through neglect to give ample room for the swarm to store honey. A few days after a swarm has been established a hurried examination should be made to note progress, and from this the beekeeper should be able to form some idea as to the time at which the super is likely to be required.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Crops.

THINNING and cultivating growing crops now requires attention; unsatisfactory crops are commonly due to the neglect or delay in the performance of these operations, and a great amount of tedious labour then produces but a moderate result. If the precaution is taken to sow the seeds thinly after giving the land early preparation which will enable it to be cleaned by germinating and destroying weed-seeds near the surface, the task is greatly simplified and a considerable economy secured. Carrots, lettuce, radish, cabbage, and cauliflower seeds are commonly sown much too thickly, which causes a serious loss in seeds and labour. After cleaning the ground in preparation for sowing, it is important to avoid digging the land or cultivating deeply before sowing is done and bringing more weed seeds near the surface.

During the month of October late crops, such as intermediate carrots, long beet, salsify, potatoes, peas, broccoli, cauliflower, savoy, red cabbage, kale, and celery are sown; also such half-hardy crops as dwarf and tall French beans, marrows, pumpkins, water and rock melons, and cucumbers.

In warm districts where a crop of globe beet and short-horn carrots may be sown in the autumn the supply of these roots is well maintained. In cooler districts where this practice is unsatisfactory crops of long beet and intermediate carrot sown now ensure a good supply in winter. Beet and salsify may generally be allowed to remain in the ground and dug as required, but the intermediate carrots will need to be lifted when mature—about the month of April—to avoid deterioration, which chiefly takes the form of splitting vertically.

In humid districts, especially if rather warm, the late potato crop runs serious risk from late blight, and Bordeaux or Burgundy sprays are needed to protect them from this attack. If fertilizers are required, and in the absence of any well-established local practice, a mixture of 3 parts of superphosphate to 1 part of sulphate of ammonia may be tried at the rate of about 5 cwt. per acre, distributing it in close proximity to the tubers when planting, which is preferable to broadcasting it for this crop. This rate works out approximately to 4 lb. of fertilizer to one hundred plants.

To maintain a varied supply of vegetables in winter, broccoli, cauliflower, kale, savoy, red cabbage, and celery are sown in beds during the month of October to raise plants for setting out early in the New Year, sometimes rather earlier, usually in ground left vacant by the removal of early crops such as peas, potatoes, &c. Broccoli and kale are very suitable for the colder districts. Young plants of the cabbage family must be protected from the attack of diamond-back moth and aphis, as serious damage is done when infected plants are set out; treatment then is also more expensive than when the young plants are together in the seed-bed. A suitable spray is composed of 2 oz. arsenate of lead paste (or 1 oz. powder), 3 teaspoonfuls nicotine sulphate, and 4 gallons of water. Dissolve and dilute each ingredient before mixing, and apply it at intervals of about fourteen days as required.

One of the commonest diseases attacking celery is leaf-spot, caused by a fungus known as *Septoria apii*. A good product can be produced only where this is kept well under control. Control should be commenced when the plants are in the seed-beds by spraying at intervals of about three weeks with Bordeaux mixture 3–4–50—that is, 3 lb. bluestone, 4 lb. hydrated lime, and 50 gallons of water. Early attention to the trouble is essential to success.

Green French beans, small marrows, melons, and cucumbers are desirable vegetables during the summer months, while dried beans and pumpkins are useful to add variety to the winter supply. In warm districts these

crops may be sown early in the month of October—in cooler localities towards the end of the month. For an early supply of melons and cucumbers, plants are sometimes raised under glass for planting out so soon as temperatures permit. It is then necessary to carefully harden them off before planting and to nurse them until they become established and conditions are safe. In a light rich alluvial soil that is well sheltered and drained these crops reach their highest development. Sweet corn is another half-hardy crop which thrives under such conditions.

Salad crops may be sown now to meet the popular demand during summer; likewise spinach, which, being less susceptible to pests is an excellent substitute for cabbage at that season of the year. In dry districts especially, silver beet and New Zealand spinach should now be planted out, as they withstand dry conditions without the quality being impaired. The latter crop appears to be most successful when the seeds are planted in autumn so soon as ripe. In a sheltered spot outside they stand the winter well, and good plants are available with little trouble for planting out.

Land from which a crop of spring cabbage or lettuce has been cleared will be in good condition for planting tomatoes after it has been ploughed and cultivated when sufficiently dry and a dressing of bonedust, superphosphate, and sulphate of potash has been drilled in along the lines where planting is to be done. To obtain a good crop the plants should be clear, sturdy, and of a good strain. A fortnight to three weeks in the cradles to harden off is a necessary preparation, and an application of Bordeaux is generally advisable before removal. Soft, rank plants and stale plants are to be avoided, as the best results to be obtained from them is a poor late crop. The demand for the fruits of egg-plants and peppers is increasing, and probably will continue to do so as the knowledge and experience in cooking and serving increases. These plants are rather more tender than the tomato, and planting out should be delayed until the weather is more settled. They are very suitable crops for the warmer districts.

Where tomatoes are grown under glass the leaf-mould disease caused by the fungus *Cladosporium fulvum* very commonly makes its appearance at this season, especially where houses have not been thoroughly fumigated before planting and high temperatures with a close atmosphere are allowed to develop at the present time. Ventilation is a most important operation in the successful production of this crop: more ventilation is now required at night, and this should be increased in the morning before the sun strikes the house. In warm districts a generous provision of ventilators is necessary to do this effectively.

Virus diseases have drawn a heavy toll from this crop during recent years, both under glass and outside. As infection is due largely to the feeding of sucking insects, the crop under glass should have an advantage in that these pests may there be readily destroyed by fumigation. They are frequently overlooked because they may be present in comparatively small numbers and the direct damage done is insignificant: it is necessary to realize that even under such circumstances the spread of virus disease by their means may be serious. These diseases may also be spread by the attendants by means of the hands or knife when pruning. Where infected plants are pulled and burnt it should be done carefully, and the operator afterwards should thoroughly wash his hands with soap. The host-range of many diseases of this class is fairly restricted; some are confined to the natural order known as *Solanaceae*, which includes tomatoes, tobacco, and potatoes, also the weed known as nightshade, which is common but which should be steadily suppressed. It is rather disturbing to hear from the Cheshunt Research Station that a number of brands of smoking-tobacco were tested and virus-disease infection was obtained from most of them: it is evidently a source of infection of very real danger where susceptible crops are grown. The virus disease known as bronze-top or spotted wilt presents special difficulties owing to its very wide host-range, which includes a strange assortment of unrelated plants, which gives the impression that the list

could be considerably added to if time could be taken to make further trial inoculations. As the natural spread of these diseases is by means of insects, dry, warm localities and seasons are conditions under which the danger is greatly increased.

Salt is a traditional dressing for asparagus crops during the spring, although it has been proved to be not so generally important as was supposed: still in some localities it increases the crop, and the question has been raised as to the quantity that should be applied. There are records of so much as 2 lb. per square yard being applied with advantage after growth has commenced. In another case application of ½ lb. to the square yard failed to keep the weeds down—a secondary result that is commonly expected. In another instance an increase of 13·5 per cent. in a crop was obtained by applying 4 oz. to the square yard. In the absence of local data it would be advisable to try 2 oz. per square yard when growth commences in the spring, repeating it two or three times at intervals of about three weeks.

Small-fruit Crops.

Well-hardened-off plants of the tree tomato, *Cyphomandra betacea*, may now be planted out in warm districts in good land that is well sheltered. This comparatively short-lived semi-shrub belongs to the plant order *Solanaceae*, and is a native of Brazil. Good plants are raised from the seeds of selected fruits, and they may now be set out 3 ft. apart and from 6 ft. to 9 ft. between the rows. The fruit, ripening in the middle of winter when there is less variety than usual, is in fairly good demand, and as a cooked dish it has aroused some enthusiasm. If the conditions are right it requires little attention. Exposure to hard frosts and high winds are the commoner causes of any losses that may take place; they destroy the large flaccid leaves.

Rather more hardy, but requiring similar conditions, are the Cape gooseberry and passion-fruit. Cape gooseberry is another member of the order *Solanaceae* from South America; but, being largely distributed from the Cape of Good Hope, it has retained a portion of that name. It extends the berry season into the winter by producing excellent culinary fruits. Plants are raised from the seeds of selected fruits sown on a hotbed in early spring or a cold frame in the autumn—the latter for preference, as bigger plants are then available for setting out 3 ft. apart and 6 ft. between the rows; the rows may be closer if the plants are supported instead of being allowed to lie on the ground. It can usually be cropped for two or three seasons before replanting is necessary.

Two or three kinds of edible passion-fruit are grown, but that known as *Passiflora edulis* is easily the favourite here. It has a comparatively hard skin of a purple colour, and is said to be a native of the West Indies. It also is raised from the seed of selected fruits, sown in autumn or spring, and the plants set out at the present time 9 ft. or 10 ft. apart, and the same distance between rows. Cropping commences the second year after planting and continues, under good conditions, for six or seven years, which is about the average life of the plant. Unless the seed is sown where the plant is to grow to maturity, it is best sown in boxes and the plants grown on in pots for planting out, as it is otherwise rather difficult to transplant.

The present time is also most suitable for planting out loganberries, which require similar conditions to the others mentioned, and may be spaced like passion-vines, but rather more closely. Both of these crops require a wire trellis for training the plants. The small fruiting plants mentioned above are of interest as being suitable for warm districts in which gooseberries, currants, and raspberries give unsatisfactory results.

It is also appropriate to mention here the progress made by growers in the production of rock melons in such localities on moist well-drained alluvial land. The small fruit of high quality that is sometimes grown is delicious summer fruit, carries well, and is in good demand. Varieties of the Cassaba class are good keepers and suitable for the drier districts.

W. C. Hyde, Horticulturist, Wellington.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FOOT-TROUBLES IN SHEEP.

M. R. H., Eketahuna :—

Owing to the prolific autumn growth, a large number of lame sheep are suffering from scald. Bluestone, 5 per cent. foot-bath, does not seem to have made any improvement.

The Live-stock Division :—

The treatment of scald in sheep does not call for strong solutions by way of foot-baths. It generally is considered that scald is the precursor to foot-rot, but one must distinguish between the two. Although a 5-per-cent. solution of bluestone is recommended for the treatment of foot-rot, one cannot recommend more than a 1-per-cent. solution in the case of scald in sheep As the same conditions predispose to both diseases, it is always advisable to examine the affected sheep thoroughly in regard to the trimming of the foot. All loose overgrown or diseased horn must be trimmed thoroughly and removed. A 1-per-cent. solution of bluestone should then prove effective as an astringent in the case of scald, and the stronger solutions should be reserved for foot-rot cases and cases showing the presence of the growth of proud flesh. It is advisable to remove the sheep to the best-drained paddocks while the treatment is being carried out.

SEEDLESS BARBERRY IN SOUTHLAND.

A. H., Kauana, Southland :—

What is the best cattle-proof hedge to plant in this locality ? Would seedless barberry grow here. The land is fair to heavy river flat.

The Horticulture Division :—

Seedless barberry has been grown as a farm hedge chiefly in the North Island, and there is little available knowledge about its behaviour for such a purpose in a southern climate. It would be best to plant it experimentally at first. Fair to heavy river flat should suit it well if the drainage is good. With macrocarpa shelter-belts to break the prevailing wind, it would possibly make a good combination.

MORTALITY IN GEESE.

F. G. H., Mangapai :—

About eighty geese and ganders have a free range of pastures and paddocks and are not fed except what they get from the grass. They have developed a complaint that is proving fatal to some. The symptoms are—Neck swells up at base of throat ; when they are hurried along they appear to get dizzy and fall over on their heads, and eventually rest on their breasts, linger, and die.

The Live-stock Division :—

Without examining the birds it is impossible to say just what the trouble is, but the symptoms you mention suggest that some of your geese are suffering from enlargement of the heart, or from dropsy of the heart-sac. Examination of a dead bird would, in the latter case, show the heart-sac full of liquid, and in the former the heart would be much enlarged. There is little known about the cause of these troubles, and, as diseases of the heart are usually not recognized while the birds are alive, treatment is not possible. With geese or ducks, especially old birds or those in too fat a condition, any excitement or over-exertion which causes an increase in the heart-beat and an increased blood pressure may result in a rupture of one of the large blood-vessels. It is well to drive geese quietly, and not to hurry or excite them too much.

WEATHER RECORDS: AUGUST, 1935.

Dominion Meteorological Office.

NOTES FOR AUGUST.

AUGUST was subject to the effects of several intense storm areas, and unsettled, squally conditions were frequently experienced; but there were various individual days as well as three more prolonged intervals when fine and mild weather prevailed. The generally fine spells covered the periods from the 1st to the 4th, 8th to the 13th, and the 22nd to the 28th, although in the latter period western areas had occasional showers. The month was remarkable for the early advent of strong westerly winds, and on this account the finest and mildest weather was experienced in districts east of the main ranges. There was little growth of pasture in parts of the east coast districts on account of the unusual dryness, but over most of the Dominion feed is plentiful and stocks have generally fared very well through the winter. On the other hand, the constant wet weather during the middle of the month in the Wairarapa and other parts of the North Island was detrimental to lambing. Fortunately, however, there were no unduly protracted or severe cold spells and no serious losses are reported.

Temperature.—At a few places in the central portion of the North Island the mean temperature was very slightly below normal, but over the rest of the Dominion the normal was exceeded.

Rainfall.—The total rainfall was again considerably below the average in the east coast districts of the South Island, and it was below, but to a less extent, in the east coast areas of the North Island between East Cape and Cook Strait. Most of the remainder of the country had more than the average.

Pressure Systems.—The month opened with fine weather, which continued until the 4th under the influence of a slight anticyclone. On the latter day the front of an intense westerly depression moved on to the Dominion, and strong northerly winds set in and were accompanied by heavy rain in western districts during the night of the 4th, and on the 5th and 6th with thunderstorms in places. The rear of this storm crossed the Dominion during the night of the 6th, when a general change to cold southerly winds took place, and heavy snow fell in the National Park area. In the east coast districts of the South Island only light and scattered rain occurred with the southerly change, and by the morning of the 7th the weather had improved over the whole of the South Island, the improvement extending over the North Island on the 8th.

From the 8th to the 13th, while an intense anticyclone was situated over New Zealand, mild and pleasant conditions prevailed throughout the Dominion.

The next important disturbance, one of the westerly type, first appeared on the 13th, and until the 21st a series of intense waves connected with it continued to cross the Dominion. During this period strong and squally winds from some westerly quarter prevailed, accompanied by heavy rain at times in districts with a westerly aspect.

From the 22nd to the close of the month an anticyclone covered the Tasman Sea, with its centre over the northern portion, but pressure remained low to the south and east of New Zealand. Consequently, winds between westerly and south-westerly predominated, occasionally rising to gale force in places. Otago and Southland suffered some damage in a south-west gale on the 24th, the gale being accompanied by heavy rain and hail in places. On the whole, however, during the period referred to, although strong winds were experienced in most districts, what rain fell was of a showery and scattered nature only and confined chiefly to western areas, very little falling in districts with an easterly aspect, but on the 31st a boisterous south-westerly brought a few heavy showers to Canterbury and some light snow in places.

RAINFALL FOR AUGUST, 1935, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
	North Island.					
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	5·32	17	1·60	5·12	45·66	38·76
Russell	4·20	17	0·99	4·70	70·02	37·30
Whangarei	5·60	18	1·01	6·31	62·78	45·10
Auckland	4·71	19	0·96	4·61	47·83	34·47
Hamilton	4·89	18	0·58	4·11	34·48	33·11
Rotorua	7·77	16	2·33	4·91	51·61	36·76
Kawhia	4·61	14	0·82	4·63	..	36·18
New Plymouth ..	8·20	22	1·30	5·49	56·99	40·41
Riversdale, Inglewood ..	10·82	17	1·96	8·89	84·35	67·60
Whangamomona ..	8·27	12	1·47	6·02	62·23	48·99
Hawera	4·58	16	0·79	4·50	43·53	30·11
Tairua	6·61	18	1·08	5·84	57·64	45·71
Tauranga	4·71	17	0·97	4·30	46·52	36·12
Maraehako Station, Opotiki	4·18	14	0·76	5·49	53·24	37·73
Gisborne	2·10	11	0·51	4·33	33·35	34·29
Taupo	5·24	13	0·95	4·07	39·17	29·30
Napier	2·08	11	1·40	2·95	39·70	22·30
Hastings	2·06	11	1·62	3·13	29·91	23·42
Whakarara Station ..	2·83	10	0·45	..	48·51	..
Taihape	4·55	19	0·72	2·74	26·63	23·52
Masterton	4·36	17	1·28	3·59	28·66	26·54
Patea	5·48	14	1·14	3·81	40·86	29·44
Wanganui	4·67	12	1·31	2·81	30·37	23·85
Foxton	4·31	10	1·20	2·95	25·21	21·33
Wellington	3·42	10	0·73	3·93	24·89	29·67
	South Island.					
Westport	10·02	25	1·84	7·70	63·98	62·50
Greymouth	10·16	23	1·58	7·48	70·06	64·97
Hokitika	9·53	24	1·41	9·24	81·01	73·29
Ross	14·69	18	3·48	10·43	84·22	82·38
Arthurs Pass	10·94	9	3·90	10·20	92·95	96·07
Okuru, South Westland	8·19	13	1·70	11·24	75·17	93·80
Collingwood	8·47	12	2·49	7·11	66·10	62·09
Nelson	6·60	12	2·58	3·06	33·73	24·86
Spring Creek, Blenheim	2·78	10	0·67	2·75	19·15	20·64
Seddon	2·05	8	0·95	1·90	12·83	16·62
Hanmer Springs ..	2·30	13	0·81	3·42	26·27	29·48
Highfield, Waiau ..	..	..	..	2·45	..	22·53
Gore Bay	1·26	7	0·56	2·64	15·04	21·31
Christchurch	1·22	8	0·38	1·82	13·94	16·99
Timaru	0·44	5	0·16	1·45	13·61	14·43
Lambrook Station, Fairlie	0·17	5	0·07	1·53	14·70	16·13
Benmore Station, Clearburn	1·43	10	1·17	1·48	15·48	16·02
Oamaru	0·82	9	0·26	1·74	13·40	14·44
Queenstown	1·92	13	0·99	2·05	22·12	19·43
Clyde	..	..	..	0·79	..	9·45
Dunedin	1·86	12	0·45	3·07	25·79	24·13
Wendon	1·46	12	0·25	2·05	24·59	19·27
Balclutha	2·22	13	0·80	1·78	23·30	16·27
Invercargill	3·08	25	0·35	3·20	36·04	29·78
Puysegur Point ..	7·95	27	0·89	6·94	60·86	55·35
Half-moon Bay ..	6·58	24	0·63	4·39	41·78	37·92